RCRA Facility Investigation Chemical Manufacturing Plant

Volume II of II: Investigation Derived Waste Report

Sloss Industries, Inc.
Birmingham, Alabama

16 December 1999
Final: 28 January 2003

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Infrastructure, buildings, environment, communications

PREPARED FOR

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ARCADIS

RCRA Facility Investigation Chemical Manufacturing Plant Volume II of II: Investigation Derived Waste Report

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GLOSSARY OF ABBREVIATIONS

BTF	Biological Treatment Facility
CFR	Code of Federal Regulations
DOT	Department of Transportation
IDW	Investigation Derived Waste
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
NPDES	National Pollution Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon
PP	Priority Pollutant
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
RBC	Risk-Based Concentration
Sloss	Sloss Industries Corporation
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Treatment, Storage, or Disposal
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1. INTRODUCTION

Sloss Industries Corporation (Sloss) in Birmingham, Alabama conducted the Chemical Manufacturing Plant and Biological Treatment Facility (BTF) and Sewers Addendum portion of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in June 1999. Additionally, the Facility-Wide and Land Disposal Areas RFI groundwater resampling was conducted to confirm the 1995 sampling results from P-13S, P-13D, and P-15, and 1997 groundwater sampling results for MW-26, MW-34S, MW-34D, and MW-32. Investigation derived waste (IDW) was generated during the course of these investigations from the installation of 9 soil borings, installation and development of 7 new monitor wells, and groundwater sampling of 14 monitor wells (Figures 1-1 through 1-4). The IDW resulted from 1) soil cuttings generated during installation of 9 soil borings, 2) soil and rock cuttings generated during the installation of the 7 new monitor wells, 3) purge water generated during development of 7 new monitor wells, and groundwater sampling of 14 monitor wells, 4) liquids and cuttings (from decontamination of drilling equipment) generated from decontamination of personnel and equipment at the decontamination pad, and 5) decontamination pad materials.

A decontamination pad for decontamination of drilling equipment was constructed on a bermed, concrete pad at the Sloss facility, near the Chemical Manufacturing Plant, using visquene. As a result of the hot, dry Birmingham summer, water used during decontamination had for the most part evaporated during the course of the Chemical Manufacturing Plant RFI, BTF and Sewers RFI Addendum and Facility-Wide and Land Disposal Areas RFI groundwater resampling investigations.

During the Chemical Manufacturing Plant, BTF and Sewers Addendum, and Facility-Wide and Land Disposal Areas groundwater resampling investigations, all IDW materials were stored in Department of Transportation (DOT) approved 55-gallon drums and initially staged adjacent to the monitor well or soil boring generating the material. The drums were properly labeled indicating the location from which the material was generated, the type of material stored, and the date generated. At the conclusion of the field program, the IDW drums were placed on pallets and centralized to a bermed, concrete pad near the Chemical Manufacturing Plant where the decontamination pad was constructed.

The U.S. Environmental Protection Agency (USEPA) Region IV guidance document, “Management of Contaminated Media,” Guidance Number TSC-92-02, dated December 28, 1992, was used as a guideline for characterization and handling of the IDW materials (Appendix A). This Chemical Manufacturing Plant IDW Report discusses the characterization rationale, sampling and analytical results, characterization of IDW, and recommended management practices for the IDW material.

2. IDW CHARACTERIZATION RATIONALE

The USEPA guidance document TSC-92-02 regarding management of contaminated media (groundwater, surface water, soils, and sediments) was used to develop the rationale for management of the IDW generated during the Chemical Manufacturing Plant, BTF and Sewers Addendum, and Facility-Wide and Land Disposal Areas groundwater resampling investigations at Sloss Industries.

2.1 USEPA POLICY

All currently available USEPA policy pertains to environmental media known to be contaminated with a listed hazardous waste. These documents collectively make up the "contained-in" policy. However, the "contained-in" policy does not address contamination from characteristic hazardous waste. Furthermore, many times there is no clear documentation that an environmental media was contaminated by either a listed or characteristic hazardous waste (as is often the case at solid waste management units). Consequently, USEPA has clarified this area as it pertains to "contaminated media" (USEPA Guidance Number TSC-92-02).

Human health and environmental risk are the basis for controlled management of IDW per USEPA Region IV guidance. By definition, a medium is "contaminated" if one or more hazardous constituents, as identified in 40 Code of Federal Regulations (CFR) Part 261 Appendix VIII, are present above levels of human health or environmental concern and above naturally occurring (background) levels (this is specifically for areas where there are naturally occurring high levels of Appendix VIII constituents). According to USEPA, contaminated environmental media should either be managed in accordance with RCRA Subtitle C requirements or "best management practices." However, if a contaminated medium is treated to concentrations at or below risk-based standards (or to naturally occurring background levels), it can be rendered "decontaminated."

2.1.1 USEPA Contaminated Media Management

Once an environmental medium is determined to be "contaminated," knowledge of how the medium became contaminated dictates how that medium must be managed. The decision matrix in Figure 2-1 was provided by USEPA to assist the user in making the correct regulatory decision for management of contaminated media. A contaminated media must ultimately be managed in one of two ways, 1) as if it were a hazardous waste, or 2) in accordance with "best management practices."

The USEPA Region IV Decision Matrix for Managing Contaminated Media, as shown in Figure 2-1, is summarized below:

1) Determine if the medium is a listed waste or contaminated by a listed waste. Both contaminated media which are themselves listed hazardous wastes (P- and U-listed wastes) and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Once a medium is decontaminated such that it no longer is a listed hazardous waste (P- and U-listed wastes) or no longer "contains" the listed hazardous waste, the Subtitle C ceases to apply.

2) Determine if the medium is contaminated by a characteristic waste. Another way in which media may become "contaminated" is through contact with a characteristic hazardous waste. If it can be validated that the medium was not contaminated by a characteristic hazardous waste, then the medium may be managed in accordance with best management practices.

3) Test for hazardous waste characteristics and determine if medium exhibits a hazardous waste characteristic. If knowledge of the originating waste stream indicates that contamination did result from a characteristic hazardous waste, or if the source of contamination is unknown, then the medium must be tested to determine whether it exhibits a hazardous waste characteristic.

4) Compare results to risk-based levels to determine if the soil is contaminated. If contaminated, best management practices should be applied.

In summary, contaminated media which are themselves hazardous wastes (P- and U-listed wastes); media which exhibit a hazardous waste characteristic; and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is a listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices should be applied.

The USEPA policy indicates that decontamination is required for all Appendix VIII constituents which are above health-based limits and background, not merely the

Appendix VIII constituent for which the waste was listed or which caused the medium to exhibit a hazardous characteristic.

2.1.2 USEPA Site Investigation Residues

Residues (purge water, drill cuttings, drilling fluids, etc.) from investigative efforts should be containerized from areas of suspected contamination or from areas where documentation does not exist to confirm that the contamination source was a listed hazardous waste until test results are available to determine whether the residue exhibits a hazardous waste characteristic (USEPA Guidance Number TSC-92-02). If the residue does not exhibit a hazardous waste characteristic, then Subtitle C regulations do not apply but the environmental sampling residues should still be managed in a manner that is protective of human health and the environment (i.e. best management practices).

Best management practices should be followed any time test results indicate residues contain hazardous constituents (Appendix VIII) above a health or environmental based limit (but the residues do not exhibit a hazardous characteristic and the contamination is not a listed waste). Best management practices suggest that contaminated sampling residues be treated or disposed in a unit that is operated in accordance with an environmental permit. If treatment or disposal in a permitted unit at the facility is not an available option, then the residues may be sent to an approved off-site facility for treatment or disposal. Alternatively, the residues may be stored at a secure location at the facility until the site under investigation is remediated. The residues should then be included in the remediation process.

2.2 SLOSS IDW CHARACTERIZATION RATIONALE

The IDW characterization rationale developed for the Chemical Manufacturing Plant, BTF and Sewers Addendum, and Facility-Wide and Land Disposal Areas groundwater resampling investigations follows the USEPA decision matrix provided in USEPA Guidance Number TSC-92-02. The following text describes how the matrix steps have been applied to the Sloss IDW contaminated during these investigations. Sloss Industries does not have a RCRA permit and therefore does not have any RCRA units. Sloss is not a Treatment, Storage, or Disposal (TSD) facility.

1) <u>Determine if the medium is a listed waste or contaminated by a listed waste:</u> Sloss Industries Corporation produces eight listed wastes: six coking wastes (K087, K141, K142, K143, K144 and K145) generated at the Coke Manufacturing Plant and F003 and F005 wastes generated at the Chemical

Manufacturing Plant. The coking wastes are exempt as specified in Alabama Department of Environmental Management Administrative Code Rule 335-14-2-.01(4)(a)(10) because these wastes are recycled to the coke ovens. The F003 and F005 wastes are disposed at a permitted hazardous waste disposal facility as necessary. During the Chemical Manufacturing Plant and BTF and Sewers Addendum investigations, monitor wells and soil borings were not installed in the vicinity of the Coke Manufacturing Plant where these wastes are produced. Soil borings were installed at the Chemical Manufacturing Plant; however, they were not installed in the area where these materials are stored.

2) Determine if the medium is contaminated by a characteristic waste. According to plant personnel, the environmental medium has not been contaminated by a characteristic waste. Analytical testing performed as part of Item (3) is used to validate this information.

3) Test for hazardous waste characteristics and determine if medium exhibits a hazardous waste characteristic. Soil, soil/rock, and groundwater data collected during the Chemical Manufacturing Plant, BTF and Sewers Addendum, and Facility-Wide and Land Disposal Areas groundwater resampling investigations were used to determine whether soil cuttings and purge water exhibit a hazardous waste characteristic. Total results obtained from the laboratory analyses of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), the thirteen Priority Pollutant (PP) metals, barium, and cyanide were compared with the toxicity characteristics (TC) levels for hazardous waste. Although toxicity characteristic leaching procedure (TCLP) analyses were not performed on drill cuttings, the soil sampling total concentration results were divided by 20, the dilution factor for the TCLP extraction, to determine if the TCLP standards could be exceeded. In the event that a metal or compound appeared to exceed the TCLP level, TCLP analysis will be performed for the analyte in question to confirm the results.

4) Compare results to risk-based levels to determine if the soil is contaminated. Sloss Industries Corporation proposes using USEPA Risk-Based Concentrations (RBCs) (October 27, 1999) for soil and tap water or Maximum Contaminant Levels (MCLs) as the risk-based levels used to determine if the soil and rock cuttings and purge water containerized at Sloss are contaminated (Appendix B). The RBCs for industrial soil ingestion will be used to evaluate the soil and rock cutting data and the USEPA MCLs (or RBCs for tap water) will be used to evaluate the purge water data (Table 2-1).

RBCs are chemical concentrations corresponding to fixed levels of risk (i.e., hazard quotient of 1, or a lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) (Appendix B). The RBCs were developed by taking toxicity constants (reference doses and carcinogenic potency slopes) and combining these constants with "standard" exposure scenarios (Appendix B). Rather than developing site specific risk-based levels, Sloss will use the conservative assumptions inherent to RBCs provided by the USEPA to evaluate proper management practices for the Chemical Manufacturing Plant, BTF and Sewers Addendum, and Facility-Wide and Land Disposal Areas groundwater resampling IDW. The use of the RBCs appears to satisfy the USEPA Guidance TSC-92-02 criteria for determining risk-based levels for management of contaminated media. The RBCs will be used to evaluate whether the IDW will be managed on site (best management practices) or disposed of offsite (as a contaminated media).

Background soil data collected during the Facility-Wide investigation is also used to determine whether the soil is contaminated (Table 2-1). For example, the naturally occurring concentrations of arsenic in the soil exceed the calculated RBC. In these cases, the cuttings are considered contaminated if concentrations exceed the arsenic background level.

3. CHARACTERIZATION OF IDW

The procedures utilized to sample and characterize the IDW soil cuttings are discussed in the following sections.

3.1 SAMPLING PROCEDURES

3.1.1 Soil and Rock Cuttings

During the subsurface soil sampling investigation at the Chemical Manufacturing Plant, IDW soil cuttings, which includes unconsolidated material such as clay and other fill materials, were containerized from the 9 soil borings installed at SWMUs 26, 27, 29, 31, and 36. Additionally, rock and soil cuttings generated during installation of the 7 new monitor wells in the BTF area were containerized.

3.1.1.1 Subsurface Soil Sampling

The subsurface soil sampling data collected during the Chemical Manufacturing Plant investigation were used to characterize the IDW soil cuttings from the 9 soil borings (Tables 3-1 through 3-5). Subsurface soil samples were analyzed from each soil boring for total VOCs (USEPA Method 8260B), SVOCs (USEPA Method 8270C), the thirteen PP metals, barium and cyanide. Soil samples were collected according to procedures discussed in Section 3.0 of the RFI Chemical Manufacturing Plant Report. Appendix C of Volume I of the RFI Chemical Manufacturing Plant Report contains soil sampling logs for the soil samples and Appendix B contains the analytical data and data validation checklists for the soil sampling. Soil sampling data are summarized in Tables 3-1 through 3-5.

3.1.1.2 IDW Rock and Soil Sampling

IDW rock and soil cuttings containerized during the installation of new monitor wells MW-38, MW-39, MW-40, MW-41, MW-42, MW-43, and MW-44 were sampled to characterize the IDW (Table 3-6). Additionally, one drum of rock and soil cuttings containerized from the decontamination pad were sampled.

IDW rock and soil samples were collected using the following procedures. In some cases, several drums of rock and soil cuttings were containerized for each well. To prevent volatilization during sampling of the IDW rock and soil cuttings, material from each drum was collected for VOC analysis using Encore™ samplers. For each monitor well with multiple drums, the VOC samples from the individual drums were composited by the laboratory before VOC analysis.

For non-volatile analysis, rock and soil cuttings were collected from each drum using a stainless steel spoon and placed in a stainless steel bowl, then thoroughly mixed using the stainless steel spoon. The material was scraped from the sides and rolled to the middle of the bowl and initially mixed. The sample was then quartered and moved to the edges of the bowl. Each quarter was then mixed individually. The quarters were then recombined into the center of the bowl and the entire sample was mixed one final time. The sample was then spooned into wide-mouth glass jars with Teflon™ lined caps. The samples were immediately placed in a cooler with ice and transported to the laboratory.

The IDW rock and soil cuttings from the new monitor wells and the decontamination pad were sampled and analyzed for total VOCs (USEPA Method 8260B), SVOCs (USEPA Method 8270C), the thirteen PP metals, barium and cyanide. Appendix C of this IDW report contains the soil sampling logs for the IDW rock and soil cutting IDW sampling. Analytical results and the data validation check list are included in Appendix B of Volume I of the RFI Chemical Manufacturing Plant Report. Rock and soil sampling data are summarized in Table 3-6.

3.1.2 Development and Purge Water

Development and groundwater sampling of 7 newly installed wells at SWMUs 13 and 21, and groundwater sampling of 7 existing monitor wells and piezometers resampled for the Facility-Wide and Land Disposal Areas RFI generated purge water which was containerized in drums. The groundwater sampling data collected during the BTF and Sewers Addendum investigation and the Facility-Wide and Land Disposal Areas groundwater resampling were used to characterize the IDW purge water. Groundwater samples were analyzed for total VOCs (USEPA Method 8260B), SVOCs (USEPA Method 8270C), the thirteen PP metals, barium and cyanide. The groundwater samples from monitor wells MW-38 through MW-44 were collected according to procedures discussed in Section 3 of the RFI BTF and Sewers Addendum Report (October 1999). Appendix A of the RFI BTF and Sewers Addendum Report contains water sampling logs for the groundwater samples and Appendix B contains the analytical data and data validation checklists for the groundwater samples. The groundwater samples from P-13D, P-13S, P-15, MW-26, MW-32, MW-34D, MW-34S were collected according to procedures discussed in Appendix A of the Response to Comments Addendum (November 19, 1999). Groundwater data are summarized in Tables 3-7 and 3-8.

3.1.3 Decontamination Pad Materials

Results from the IDW soil cuttings will be used to characterize the drummed visquene from the decontamination pad (Table 3-6). These analytical results will characterize any soil cutting residue remaining on the visquene.

3.2 CHARACTERIZATION OF SOIL AND ROCK CUTTING IDW

Subsurface soil samples collected during the Chemical Manufacturing Plant investigation and the IDW rock and soil cutting samples collected during the BTF and Sewers Addendum investigation were analyzed for VOCs, SVOCs, PP metals, barium and cyanide. Eight VOCs, 23 SVOCs including 17 polycyclic aromatic hydrocarbons (PAHs), 12 PP metals, barium, and cyanide were detected in the IDW soil and rock cuttings. The subsurface soil sampling results are summarized in Tables 3-1 through 3-5 and in Section 4 of Volume I of the RFI Chemical Manufacturing Plant Report. The IDW rock and soil cutting results are discussed below and presented in Table 3-6.

3.2.1 Hazardous Waste Characteristics

Based on a review of the available analytical data, IDW soil cuttings from soil borings 26-SB0001 and 27-SB0002 containerized during the Chemical Manufacturing Plant investigation may exhibit characteristics of hazardous waste because total results for benzene detected in 26-SB0001 and benzene and chlorobenzene detected in 27-SB0002 soil cuttings may exceed RCRA TC Levels (Tables 3-1 and 3-2). TCLP analysis for VOCs will be performed on the soil cuttings from soil boring 26-SB0001 and 27-SB0002 to determine whether the cuttings are hazardous.

3.2.2 Contaminated Soil and Rock Cutting IDW

Based on a review of the available analytical data, IDW soil cuttings from one soil boring and IDW rock and soil cuttings from three new monitor wells contained concentrations which exceeded USEPA Industrial RBCs for soil ingestion (Tables 3-1 through 3-6, 3-9, and 3-10).

VOC compounds detected did not exceed USEPA Industrial RBCs for soil ingestion. Benzo(a)pyrene exceeded the USEPA Industrial RBC for soil ingestion in soil cuttings containerized from soil boring 26- SB0001 and rock and soil cuttings containerized from monitor wells MW-40, MW-41, and MW-43 (Tables 3-1 and 3-6). Benzo(a)pyrene also exceeded the USEPA Industrial RBC for soil ingestion in soil cuttings containerized from the decontamination pad. Additionally concentrations of benzo(a)anthracene and benzo(b)fluoranthene detected in rock and soil cuttings containerized from monitor well MW-41 exceeded USEPA Industrial RBCs.

The USEPA Industrial RBC for arsenic was exceeded in a number of the soil borings and rock and soil cuttings from monitor wells (Tables 3-1 through 3-6). In order to evaluate this data, it was necessary to evaluate background concentrations of these constituents. This conclusion was reached based upon USEPA Guidance Number TSC-92-02 which indicates background concentrations can be used to determine if a waste is contaminated.

Site background concentrations of arsenic detected range from 1.9 to 21 milligrams per kilogram (mg/kg). The concentrations of arsenic detected in the IDW soil cuttings and rock and soil cuttings are within the site background concentration ranges for these compounds based on background soil data collected at the site.

Based on these results, the IDW soil cuttings from soil borings 26-SB0001, soil and rock cuttings from monitor wells MW-40 and MW-43, and the decontamination pad are considered contaminated because of benzo(a)pyrene. Soil and rock cuttings from monitor well MW-41 are considered contaminated because of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene.

3.3 CHARACTERIZATION OF PURGE WATER IDW

Groundwater samples collected during the BTF and Sewers RFI Addendum and Facility-Wide and Land Disposal Areas RFI resampling investigations were analyzed for VOCs, SVOCs, PP metals, barium and cyanide. Seven VOCs, 18 SVOCs including 15 PAHs, seven metals, and cyanide were detected in the IDW purge water. These groundwater sampling results are summarized in Tables 3-7 and 3-8, in Section 4 of the BTF and Sewers RFI Addendum Report ,and Appendix A of the Response to Comment Addendum (November 19, 1999)

3.3.1 Hazardous Waste Characteristics

Based on a review of the available analytical data, none of the IDW purge water containerized during the BTF and Sewers Addendum investigation and the Facility-Wide and Land Disposal Areas RFI resampling exhibit characteristics of hazardous waste (Tables 3-7, 3-8, and 3-11)

3.3.2 Contaminated Purge Water IDW

Based on a review of the available analytical data, IDW purge water from eight of the monitor wells contained concentrations which exceeded USEPA MCLs (Tables 3-7, 3-8 and 3-11).

Benzene detected in P-13S, MW-26, MW-38, MW-40, MW-41 and vinyl chloride detected in P-13S and P-13D exceeded USEPA MCLs (Tables 3-7, 3-8, and 3-11). Seven PAHs exceeded USEPA MCLs or RBCs for tap water in MW-41. Benzo(a)pyrene exceeded the USEPA MCL and benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene exceeded USEPA RBCs for tap water. Additionally, naphthalene concentrations detected in MW-38, MW-39, and MW-40 exceeded the USEPA RBC for tap water.

One metal and cyanide exceeded USEPA MCLs. The USEPA MCL for lead was exceeded in MW-39 and MW-41 and the MCL for cyanide was exceeded in MW-32 and MW-41 (Tables 3-7, 3-8, and 3-11).

Based on these results, the IDW purge water from two piezometers P-13S and P-13D and six monitor wells MW-26, MW-32, MW-38, MW-39, MW-40, and MW-41are considered contaminated because of benzene, vinyl chloride, PAHs, lead, or cyanide concentrations (Table 3-11).

3.4 DECONTAMINATION PAD MATERIALS

3.4.1 Hazardous Waste Characteristics

Since none of the IDW soil cuttings from the decontamination pad exhibited characteristics of hazardous waste (Section 3.2.1), it follows that the decontamination pad materials do not exhibit characteristics of hazardous waste (Tables 3-6 and 3-10).

3.4.2 Contaminated Materials

Based on a review of the analytical data for the IDW soil cuttings collected from the decontamination pad, it follows that the decontamination pad materials are contaminated (Tables 3-6 and 3-10).

4. PROPOSED WASTE MANAGEMENT PRACTICES

4.1 Soil and Rock Cutting IDW

Since IDW soil cuttings from 26-SB0001 and 27-SB0002 contained concentrations of benzene and chlorobenzene that may exceed RCRA TC Levels, these soil cuttings have been characterized as hazardous (Table 3-9). The drummed soil cuttings will be sampled and analyzed for TCLP VOCs to determine it the cuttings are hazardous.

IDW rock and soil cuttings from monitor wells MW-40, MW-41, and MW-43 and the decontamination pad contained concentrations of SVOCs (benzo(a)pyrene, benzo(a)anthracene and benzo(b)fluoranthene) which exceeded USEPA Industrial RBCs (Tables 3-1 through 3-6). Because the rock and soil cuttings from these monitor wells contained concentrations of compounds that exceeded the RBCs, the cuttings have been characterized as contaminated media. Benzo(a)pyrene also exceeded the Industrial RBC in soil boring 26-SB0001, however, this sample was characterized as hazardous because of detected concentrations of benzene.

The proposed best management practice for handling and disposal of the IDW soil characterized as contaminated is to handle the five drums containing contaminated cuttings as if they were a hazardous waste and dispose of the material accordingly (Tables 3-9 and 3-10). Although this material is non-hazardous, solid waste landfills may hesitate to accept the IDW soil cuttings because they are contaminated.

The IDW soil cuttings from the remaining soil borings and rock and soil cuttings from the monitor wells did not contain concentrations of compounds which exceed USEPA industrial RBCs or the site background soil range for arsenic (Tables 3-9 and 3-10). The proposed best management practice for handling the IDW soil cuttings is to place the material at the on site land disposal area, Solid Waste Management Unit (SWMU) 38, Landfill. After removing the IDW soil cuttings, the drums will be triple rinsed, crushed, and placed in the metal scrap pile for recycling at the U.S. Pipe North Birmingham facility. Rinse waters will be collected/directed to the BTF.

4.2 Development and Purge Water IDW

Characterization of IDW purge water indicated that none of the IDW water has characteristics of hazardous waste (Table 3-11).

IDW purge water containerized from seven monitor wells contained concentrations of two VOCs (benzene and vinyl chloride), 7 SVOC (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene), one metal (lead), and cyanide which exceeded USEPA MCLs or RBCs for tap water (Tables 3-11). Because the purge water from piezometers P-13S and P-13D and monitor wells MW-26, MW-32, MW-38, MW-39, MW-41 contained concentrations of compounds which exceeded USEPA MCLs, the purge water has been characterized as contaminated media. The proposed best management practice for handling and disposal of the IDW purge water for these monitor wells is to dispose of the water in the BTF with site process water (Table 3-11). This facility is capable of processing the water and will not result in any exceedences of the Facility's National Pollution Discharge Elimination System (NPDES) permit.

The IDW purge water from MW-42, MW-43, and MW-44 do not contain concentrations of compounds that exceed USEPA MCLs (Table 3-11). The proposed best management practice for the purge water from these monitor wells is to dispose of the water in the BTF at the Sloss Facility.

In some cases, purge water from several monitor wells/piezometers were combined in a drum:

- Purge water from P-13D and MW-34D was containerized in a drum,
- Purge water from P-13S and MW-34S was containerized in a drum,
- Purge water from MW-38, MW-39, MW-26, and P-15 was containerized in a drum, and

- Purge water from MW-41, MW-42, and MW-43 was containerized in a drum.

The analytical results from the most contaminated well/piezometer were used to characterize the purge water containerized in these drums. All of the drums containing purge water from multiple wells/piezometers were characterized as contaminated (Table 3-11).

After disposing of the IDW purge water, the drums will be triple rinsed, crushed, and placed in the metal scrap pile for recycling at the U.S. Pipe North Birmingham facility. Rinse waters will also be collected/directed to the BTF.

4.3 Decontamination Pad Materials

Since IDW soil cuttings collected from the decontamination pad contained concentrations of benzo(a)pyrene that exceeded USEPA Industrial RBCs, the decontamination pad materials have been characterized as contaminated media.

The proposed best management practice for handling and disposal of the decontamination pad materials characterized as contaminated is to handle the five drums containing decontamination pad materials as if they were a hazardous waste and dispose of the material accordingly (Table 3-10). Although this material is non-hazardous, solid waste landfills may hesitate to accept the decontamination pad materials because they are contaminated.

5. REFERENCES

US. Environmental Protection Agency, 1997. Risk-Based Concentration Table, October 22, 1997. USEPA Region III, Philadelphia, Pennsylvania. October 22, 1997 Memorandum.

U. S. Environmental Protection Agency, 1992. Management of Contaminated Media. Guidance Number TSC-92-02. USEPA Region IV, Atlanta, GA. December 28,1992 Memorandum

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FIGURES

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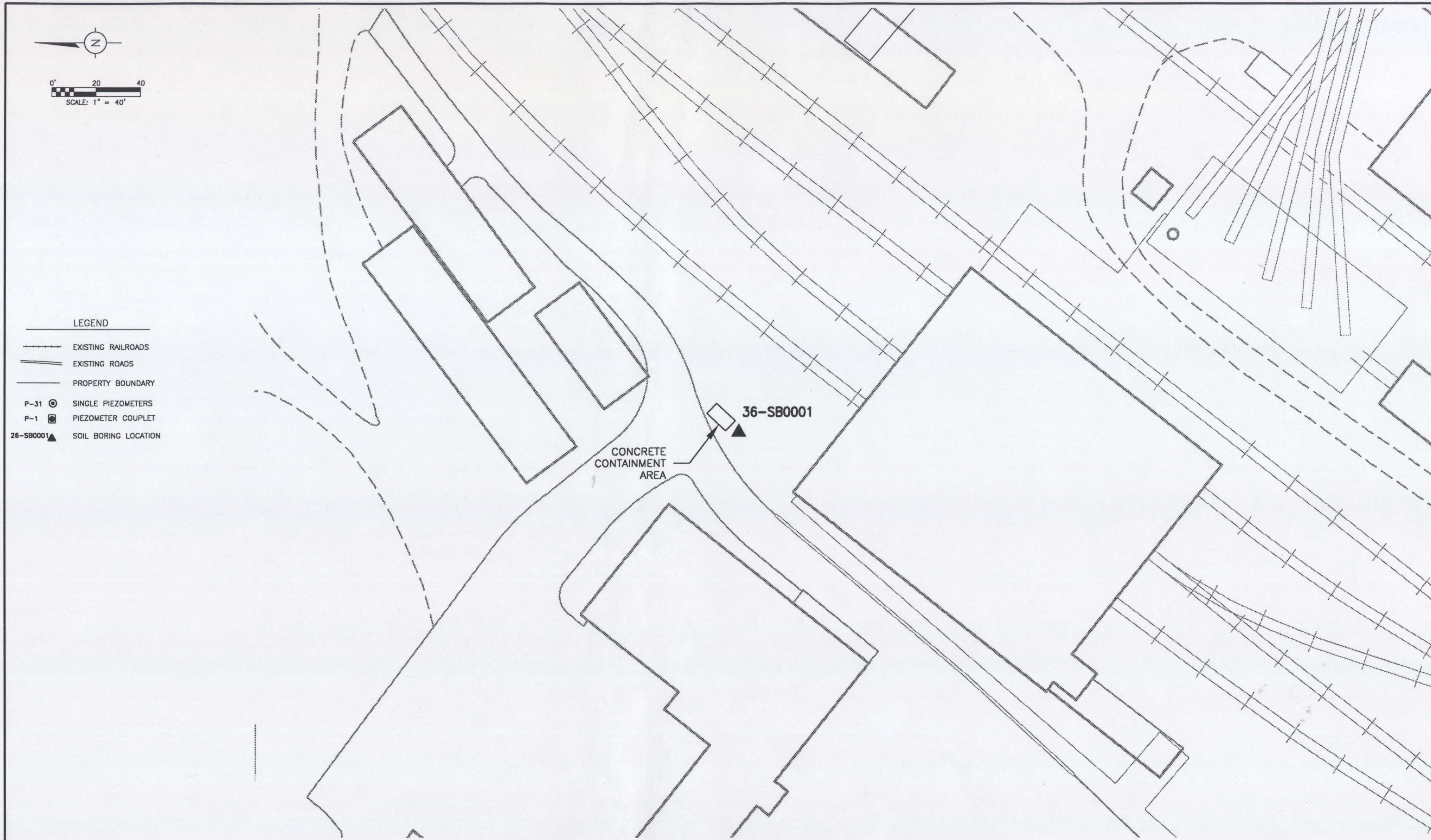
CHEMICAL MANUFACTURING PLANT SWMU's 26,27,29, AND 31
SOIL BORING LOCATION MAP

CHEMICAL MANUFACTURING PLANT RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
1-1



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MAINTENANCE SHOP USED OIL TANK(SWMU-36)
SOIL BORING LOCATION MAP

CHEMICAL MANUFACTURING PLANT RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
1-2

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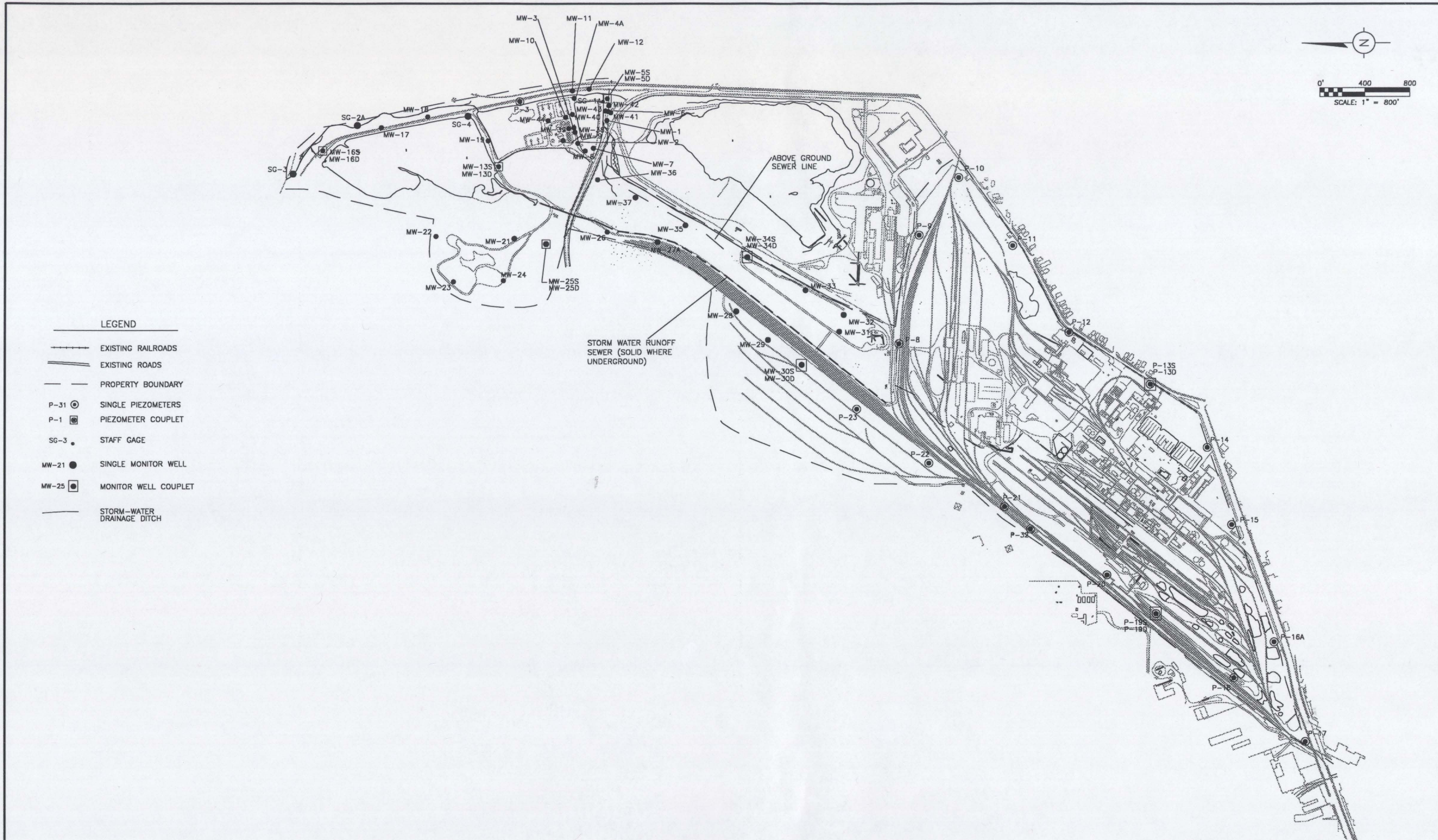
BTF AREA MONITOR WELL LOCATION MAP

CHEMICAL MANUFACTURING PLANT RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
1-3



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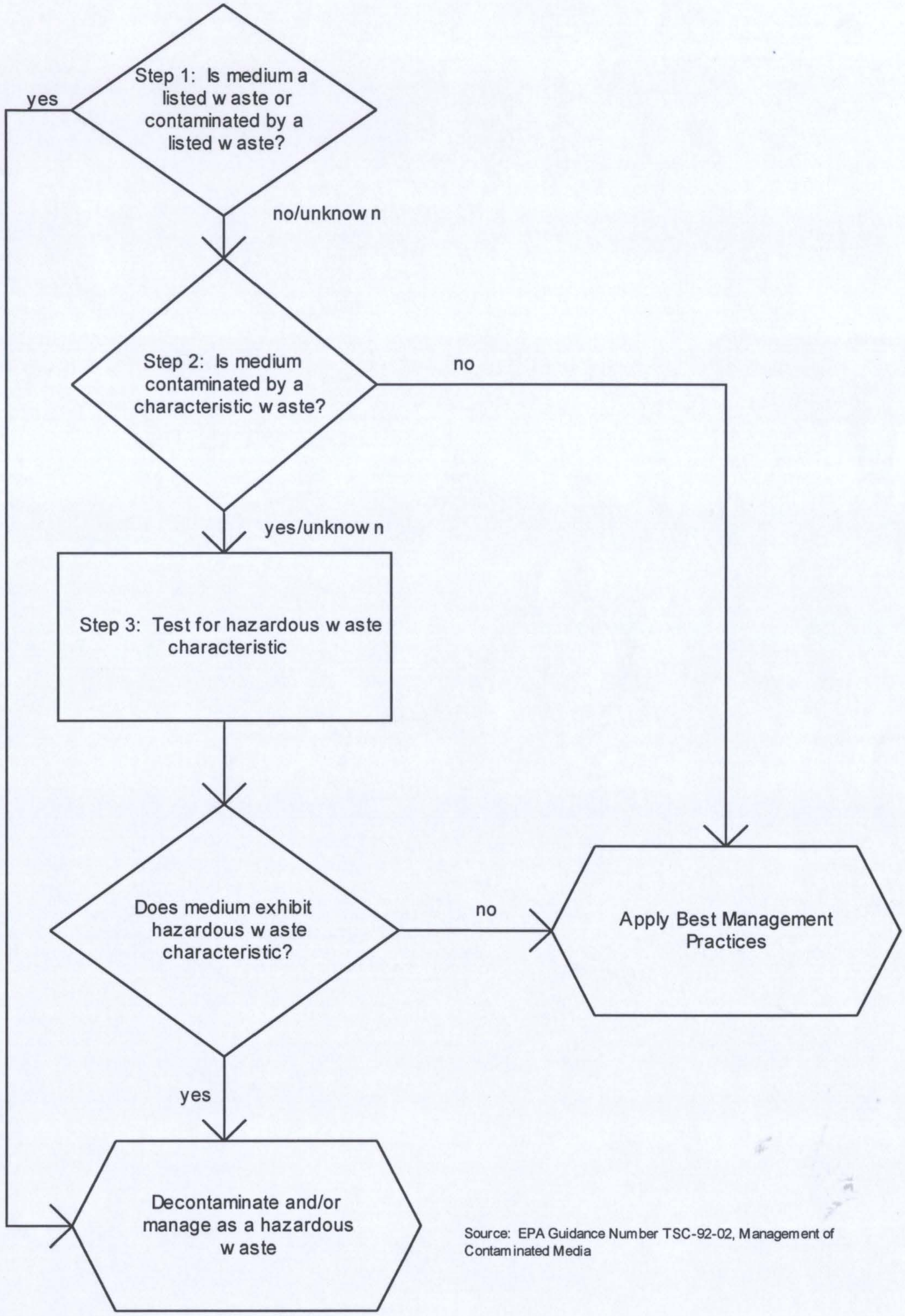
DATE 12/16/99	PROJECT MANAGER PF	PROJECT OFFICER PF
DRAWN BJH	LEAD DESIGN PROF. KT	CHECKED KT
CADD FILE NAME SIDW1-4.DWG	PROJECT NUMBER TF000320.0016	

MONITOR WELL AND PIEZOMETER LOCATION MAP

CHEMICAL MANUFACTURING PLANT RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
1-4



Source: EPA Guidance Number TSC-92-02, Management of Contaminated Media

ARCADIS GERAGHTY & MILLER 14497 North Dale Mabry Hwy., Suite 115 Tampa, Florida 33618 Tel: 813/961-1921 Fax: 813/961-2599 Date: 12/10/98	DECISION MATRIX FOR MANAGING CONTAMINATED MEDIA	FIGURE 2-1

j:\proj\tf320\btfsewer\rpt\tables\Matrix.xls

TABLES

TABLE 2-1
Summary of Site Background Soil Concentration Ranges
and USEPA Risk Based Concentrations
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

	Chemical	Background Concentration Range			USEPA RBC Soil Ingestion Residential 1/	USEPA RBC Soil Ingestion Industrial 1/
Volatile Organic Compounds (ug/kg):						
	Acetone	26	-	38	7,800,000	200,000,000
	Benzene		ND		22,000	200,000
	Chlorobenzene		ND		1,600,000	41,000,000
	Ethylbenzene		ND		7,800,000	200,000,000
	Tetrachloroethene	0.58	-	20	12,000	110,000
	Toluene	1	-	7.4	16,000,000	410,000,000
	Vinyl chloride		ND		340	3,000
	Xylenes	5.8	-	7.4	160,000,000	4,100,000,000
Semivolatile Organic Compounds (ug/kg):						
	1,2,4-Trichlorobenzene		ND		780,000	20,000,000
*	2-Methylnaphthalene		ND		1,600,000	41,000,000
	2-Methylphenol (o-cresol)		ND		3,900,000	100,000,000
	4-Methylphenol (p-cresol)		ND		390,000	10,000,000
*	Acenaphthene		ND		4,700,000	120,000,000
*	Acenaphthylene		ND		NS	NS
*	Anthracene		ND		23,000,000	610,000,000
*	Benzo(a)anthracene	33	-	33	870	7,800
*	Benzo(a)pyrene	40	-	40	87	780
*	Benzo(b)fluoranthene	65	-	66	870	7,800
*	Benzo(g,h,i)perylene		ND		NS	NS
*	Benzo(k)fluoranthene		ND		8,700	78,000
	Bis(2-ethylhexyl)phthalate	31	-	31	46,000	410,000
*	Chrysene	43	-	43	87,000	780,000
*	Dibenzo(a,h)anthracene		ND		87	780
	Dibenzofuran		ND		310,000	8,200,000
*	Fluoranthene	58	-	61	3,100,000	82,000,000
*	Fluorene		ND		3,100,000	82,000,000
*	Indeno(1,2,3-cd)pyrene		ND		870	7,800
*	Naphthalene	44	-	48	1,600,000	41,000,000
*	Phenanthrene	30	-	30	NS	NS
	Phenol		ND		47,000,000	1,200,000,000
*	Pyrene	52	-	52	2,300,000	61,000,000

Footnotes of page 2.

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TABLE 2-1
Summary of Site Background Soil Concentration Ranges
and USEPA Risk Based Concentrations
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Chemical	Background Concentration Range			USEPA RBC Soil Ingestion Residential [1/]	USEPA RBC Soil Ingestion Industrial [1/]
Metals (mg/kg):					
Antimony, Total		ND		31	820
Arsenic, Total	1.9	-	21	0.43	3.8
Barium, Total	14	-	200	5,500	140,000
Beryllium, Total	0.44	-	2.6	160	4,100
Cadmium, Total		ND		39	1,000
Chromium, Total [2/]	8.6	-	46	230	6,100
Copper, Total	5	-	32	3,100	82,000
Lead, Total	5	-	23	400	NS
Mercury, Total [3/]	0.03	-	0.2	7.8	200
Nickel, Total	4.7	-	47	1,600	41,000
Selenium, Total		ND		390	10,000
Thallium, Total	1.1	-	1.3	5.5	140
Zinc, Total	8.6	-	71	23,000	610,000
Cyanide, Total (mg/kg)		ND		1,600	41,000

ND - Not Detected. This constituent was not detected in site background soil samples.
NS - No Standard.
[1/] Source: USEPA Region III Risk-Based Concentrations (RBCs), October 27, 1999.
[2/] Chromium VI RBC.
[3/] Methylmercury RBC.

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TABLE 3-1
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU26 in June 1999
Chemical Manufaturing Plant RFI
Sloss Industries Corporation

			26-SB0001			26-SB0002		
Sample ID	USEPA RBC Soil Ingestion Industrial 1/	RCRA TC Level 4/	990609-CM-26-SL0001(5-7)	990609-CM-26-SL0001(9-11)	990609-CM-26-SL0001(13-15)	990609-CM-26-SL0002(2-4)	990609-CM-26-SL0002(4-6)	990609-CM-26-SL0002(6-8)
Lab ID			108995-7	108995-8	108995-9	108995-10	108995-11	108995-12
Sample Date			6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999
Volatile Organic Compounds (ug/kg):								
Benzene	200,000	500	15000	10000	5500	2900	8400	2400
Semivolatile Organic Compounds (ug/kg):								
* 2-Methylnaphthalene	41,000,000	NS	<410	3100	<410	<430	<460	<390
4-Methylphenol (p-cresol)	10,000,000	200,000	<410	400	<410	<430	<460	<390
* Acenaphthene	120,000,000	NS	<410	680	<410	<430	<460	<390
* Acenaphthylene	NS	NS	<410	1900	<410	<430	<460	<390
* Anthracene	610,000,000	NS	<410	2400	<410	<430	<460	<390
* Benzo(a)anthracene	7,800	NS	<410	5400	<410	<430	<460	<390
* Benzo(a)pyrene	780	NS	<410	3600	<410	<430	<460	<390
* Benzo(b)fluoranthene	7,800	NS	<410	4900	<410	<430	<460	<390
* Benzo(g,h,i)perylene	NS	NS	<410	1900	<410	<430	<460	<390
* Benzo(k)fluoranthene	78,000	NS	<410	2100	<410	<430	<460	<390
Bis(2-ethylhexyl)phthalate	410,000	NS	<410	<410	430	<430	690	<390
* Chrysene	780,000	NS	<410	4000	<410	<430	<460	<390
* Dibenzo(a,h)anthracene	780	NS	<410	510	<410	<430	<460	<390
Dibenzofuran	8,200,000	NS	<410	2100	<410	<430	<460	<390
* Fluoranthene	82,000,000	NS	<410	14000	1000	<430	<460	<390
* Fluorene	82,000,000	NS	<410	4000	<410	<430	<460	<390
* Indeno(1,2,3-cd)pyrene	7,800	NS	<410	1900	<410	<430	<460	<390
* Naphthalene	41,000,000	NS	<410	38000	1500	<430	<460	<390
* Phenanthrene	NS	NS	<410	14000	1100	<430	<460	<390
* Pyrene	61,000,000	NS	<410	8800	560	<430	<460	<390
Metals (mg/kg):								
Antimony, Total	820	NS	0.59 J	<0.6 R	0.65 J	0.6 J	<0.69 R	<0.54 R
Arsenic, Total	3.8	5	2.3	3.5	3.3	4	5.1	5.3

Footnotes on page 2.

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TABLE 3-1
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU26 in June 1999
Chemical Manufaturing Plant RFI
Sloss Industries Corporation

			26-SB0001			26-SB0002		
Sample ID	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990609-CM-26-SL0001(5-7)	990609-CM-26-SL0001(9-11)	990609-CM-26-SL0001(13-15)	990609-CM-26-SL0002(2-4)	990609-CM-26-SL0002(4-6)	990609-CM-26-SL0002(6-8)
Lab ID			108995-7	108995-8	108995-9	108995-10	108995-11	108995-12
Sample Date			6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999
Barium, Total	140,000	100	8.7	12	12	27	23	30
Cadmium, Total	1,000	1	1.4 J	1.2 J	1.6 J	1.2 J	1 J	0.74 J
Chromium, Total [2/]	6,100	5	20 J	19 J	19 J	8.6 J	10 J	18 J
Copper, Total	82,000	NS	<0.23 R	<0.24 R	<0.23 R	2.7 J	4.7 J	<0.22 R
Lead, Total	400 [4/]	5	6.6 J	11 J	6.6 J	6.9 J	7.4 J	15 J
Nickel, Total	41,000	NS	1.7 J	2.5 J	2.9 J	4.4 J	4.7 J	2.7 J
Thallium, Total	140	NS	0.06	0.06	0.03	0.07	0.08	0.08
Zinc, Total	610,000	NS	3 UJ	4.1 UJ	5.4 UJ	7.4 UJ	10 UJ	4.8 UJ
Cyanide, Total (mg/kg):	41,000	NS	1.7	1.7	1.7	<0.26	<0.28	2.4

Footnotes:

NS No Standard.
J Positive results have been classified as qualitative during data validation.
UJ Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
R Data classified as unusable.
ug/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
1/ Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/ RBC for Chromium VI.
3/ Residential RBC
4/ TC Levels fro VOCs and SVOCs are in micrograms per liter (ug/L) and for metals are in milligrams per liter (mg/L)
Concentration exceeds Industrial RBC.
Concentration may exceed RCRA TC level
* Polycyclic aromatic hydrocarbon compound.

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TABLE 3-2
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 27 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Sample ID	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	27-SB0001 990610-CM-27-SL0001(2-4)	27-SB0001 990610-CM-27-SL0001(6-8)	27-SB0001 990610-CM-27-SL0001(10-12)	27-SB0002 990611-CM-27-SL0002(3-5)	27-SB0002 990611-CM-27-SL0002(5-7)	27-SB0002 990611-CM-27-SL0002(9-11)
Lab ID			109054-1	109054-2	109054-3	109119-8	109119-6	109119-7
Sample Date			6/10/1999	6/10/1999	6/10/1999	6/11/1999	6/11/1999	6/11/1999
Volatile Organic Compounds (ug/kg):								
Benzene	200,000	500	3400	890	1600	8600	14000	1200
Chlorobenzene	41,000,000	100,000	420000	72000	29000	350000	6100000	330000
Toluene	410,000,000	NS	1000000	42000	17000	130000	160000	14000
Xylenes	410,000,000	NS	4900	<320	<330	540	1300	<340
Semivolatile Organic Compounds (ug/kg):								
2-Methylphenol (o-cresol)	100,000,000	200,000	670	<430	<430	<430	<420	<450
4-Methylphenol (p-cresol)	10,000,000	200,000	860	<430	<430	<430	<420	<450
Phenol	1,200,000,000	NS	85000	91000	670	67000	180000	180000
Metals (mg/kg):								
Arsenic, Total	3.8	5	5.1	15	4.8	18	11	10
Barium, Total	140,000	100	27 J	12 J	13 J	21 J	20 J	21 J
Beryllium, Total	4,100	NS	<0.06 UJ	0.55 J	0.2 J	<0.07 R	<0.06 R	<0.07 R
Cadmium, Total	1,000	1	0.83 J	0.25 J	0.34 J	2 J	1.8 J	1.6 J
Chromium, Total [2/]	6,100	5	36 J	2 J	2.8 J	22 J	17 J	13 J
Copper, Total	82,000	NS	<0.24 R	0.94 J	1.8 J	1.3 J	<0.25 UJ	<0.26 UJ
Lead, Total [3/]	400	5	24 J	30 J	2.5 J	46 J	6.1 J	5.2 J
Nickel, Total	41,000	NS	12 J	3.1 J	3.6 J	2.7 J	3.1 J	2.6 J
Selenium, Total	10,000	1	<0.12 UJ	<0.13 UJ	<0.12 UJ	1.2 J	1 J	0.89 J
Thallium, Total	140	NS	0.11	0.08	0.07	0.09	0.07	0.07
Zinc, Total	610,000	NS	11 UJ	2.2 UJ	4.6 UJ	8.2 UJ	8.1 UJ	6.2 UJ

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TABLE 3-2
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 27 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			27-SB0001			27-SB0002		
Sample ID	USEPA RBC Soil Ingestion	RCRA TC Level [4/]	990610-CM-27-SL0001(2-4)	990610-CM-27-SL0001(6-8)	990610-CM-27-SL0001(10-12)	990611-CM-27-SL0002(3-5)	990611-CM-27-SL0002(5-7)	990611-CM-27-SL0002(9-11)
Lab ID	Industrial [1/]		109054-1	109054-2	109054-3	109119-8	109119-6	109119-7
Sample Date			6/10/1999	6/10/1999	6/10/1999	6/11/1999	6/11/1999	6/11/1999
Cyanide, Total (mg/kg):	41,000	NS	<0.25	<0.26	<0.26	0.28	<0.26	0.32

Footnotes:

NS	No Standard.
J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
R	Data classified as unusable.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/	RBC for Chromium VI.
3/	Residential RBC.
4/	TC Levels for VOCs and SVOCs are in micrograms per liter (ug/L) and for metals are in milligrams per liter (mg/L).
(box)	Concentration exceeds Industrial RBC.
(shaded box)	Concentration may exceed RCRA TC level.

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TABLE 3-3
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 29 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			29-SB0001				29-SB0002
Sample ID	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [5/]	990609-CM-29-SL0001(4-6)	990609-CM-29-SL9001	990609-CM-29-SL0001(8-10)	990609-CM-29-SL0001(12-13)	990609-CM-29-SL0002(4-4.5)
Lab ID			108995-1	108995-3	108995-4	108995-6	108995-13
Sample Date			6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999
Volatile Organic Compounds (ug/kg):							
Acetone	200,000,000	NS	<3400 J	3400 J	<3300	<3500	<3500
Benzene	200,000	500	5000	3100	3900	6500	59000
Chlorobenzene	41,000,000	100,000	19000 J	8400 J	15000	22000	21000
Ethylbenzene	200,000,000	NS	<340	<340	<330	<350	930
Tetrachloroethene	110,000	700	<340	<340	<330	<350	1200
Toluene	410,000,000	NS	210000 J	99000 J	120000	210000	36000
Vinyl chloride	3,000	200	<68	<68	<67	<70	87
Xylenes	4,100,000,000	NS	8100 J	3600 J	4600	5800	12000
Semivolatile Organic Compounds (ug/kg):							
1,2,4-Trichlorobenzene	20,000,000	NS	<450	<450	<440	<460	930
2-Methylphenol (o-cresol)	100,000,000	200,000	<450	<450	470	490	<460
4-Methylphenol (p-cresol)	10,000,000	200,000	1300	930	1500	1300	520
Bis(2-ethylhexyl)phthalate	410,000	NS	<450	<450	600	750	<460
Phenol	1,200,000,000	NS	11000 J	6800 J	7100 J	35000	2000
Metals (mg/kg):							
Arsenic, Total	3.8	5	$\boxed{5.6}$	$\boxed{5.5}$	$\boxed{6.2}$	2.9	$\boxed{4}$
Barium, Total	140,000	100	19	15	4.2	19	26
Beryllium, Total	4,100	NS	<0.06 UJ	<0.07 UJ	0.95 J	0.2 J	<0.07 UJ
Cadmium, Total	1,000	1	1.4 J	1.2 J	<0.06 UJ	0.4 J	0.65 J
Chromium, Total [2/]	6,100	5	9.8 J	8.5 J	0.64 J	2.2 J	6.4 J
Copper, Total	82,000	NS	2.3 J	1.4 J	0.86 J	4.2 J	1.1 J
Lead, Total [3/]	400	5	5.9 J	4.7 J	0.85 J	2.4 J	3.3 J
Mercury, Total [4/]	200	200	<0.34	<0.34	<0.33	<0.35	2.4

Footnotes on Page 2.

TABLE 3-3
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 29 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			29-SB0001				29-SB0002
Sample ID	USEPA RBC Soil Ingestion	RCRA TC Level [5/]	990609-CM-29-SL0001(4-6)	990609-CM-29-SL9001	990609-CM-29-SL0001(8-10)	990609-CM-29-SL0001(12-13)	990609-CM-29-SL0002(4-4.5)
Lab ID	Industrial [1/]		108995-1	108995-3	108995-4	108995-6	108995-13
Sample Date			6/9/1999	6/9/1999	6/9/1999	6/9/1999	6/9/1999
Nickel, Total	41,000	NS	5.7 J	5.5 J	2.4 J	5.6 J	4.1 J
Thallium, Total	140	NS	0.07	0.1	0.08	0.05	0.09
Zinc, Total	610,000	NS	11 UJ	9.5 UJ	1.7 UJ	7.6 UJ	6.8 UJ
Cyanide, Total (mg/kg):	41,000	NS	<0.27	<0.27	0.31	<0.28	<0.28

Footnotes:

NS	No Standard.
J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/	RBC for Chromium VI.
3/	Residential RBC.
4/	Methylmercury RBC.
5/	TC Levels for VOCs and SVOCs are in micrograms per liter (ug/L) and for metals are in milligrams per liter (mg/L).
[empty box]	Concentration exceeds Industrial RBC.

TABLE 3-4
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 31 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			31-SB0001			31-SB0002		
Sample ID	USEPA RBC Soil Ingestion	RCRA TC Level [4/]	990610-CM-31- SL0001(0.5-2)	990610-CM-31- SL0001(2-4)	990610-CM-31- SL0001(6-8)	990610-CM-31- SL0002(2-4)	990610-CM-31- SL0002(4-6)	990610-CM-31- SL0002(8-10)
Lab ID	Industrial [1/]		109054-4	109054-5	109054-6	109054-7	109054-8	109054-9
Sample Date			6/10/1999	6/10/1999	6/10/1999	6/10/1999	6/10/1999	6/10/1999
Volatile Organic Compounds (ug/kg):								
Benzene	200,000	500	2300	760	810	3300	530	<330
Chlorobenzene	41,000,000	100,000	2100	1000	<300	3000	<340	<330
Ethylbenzene	200,000,000	NS	32000	11000	770	390	<340	<330
Toluene	410,000,000	NS	10000	8700	2300	3400	340	<130
Xylenes	4,100,000,000	NS	160000	31000	5100	2000	<340	<330
Semivolatile Organic Compounds (ug/kg):								
4-Methylphenol (p-cresol)	10,000,000	200,000	<420	<410	700	<400	<450	<440
Phenol	1,200,000,000	NS	20000	1200	1200	760	790	<440
Metals (mg/kg):								
Antimony, Total	820	NS	0.61 J	1.2 J	0.76 J	0.98 J	<0.67 R	<0.66 R
Arsenic, Total	3.8	5	8.4	5.3	5.2	4.3	4.3	1.5
Barium, Total	140,000	100	39 J	49 J	48 J	98 J	42 J	31 J
Beryllium, Total	4,100	NS	<0.06 UJ	<0.06 UJ	<0.06 UJ	<0.06 UJ	0.48 J	0.21 J
Cadmium, Total	1,000	1	1.5 J	3.4 J	1.8 J	3.6 J	1.1 J	0.26 J
Chromium, Total [2/]	6,100	5	22 J	23 J	13 J	19 J	9.5 J	3.5 J
Copper, Total	82,000	NS	13 J	<0.24 R	<0.24 R	<0.22 R	<0.27 R	0.48 J
Lead, Total [3/]	400	5	16 J	18 J	15 J	86 J	6 J	2.7 J
Nickel, Total	41,000	NS	5.1 J	2.8 J	2.7 J	2.8 J	5.7 J	6.1 J
Thallium, Total	140	NS	0.09	0.09	0.06	0.07	0.09	0.04
Zinc, Total	610,000	NS	23 UJ	7.8 UJ	5.6 UJ	7.2 UJ	5.5 UJ	4.6 UJ

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TABLE 3-4
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 31 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			31-SB0001			31-SB0002		
Sample ID	USEPA RBC Soil Ingestion	RCRA TC Level [4/]	990610-CM-31-SL0001(0.5-2)	990610-CM-31-SL0001(2-4)	990610-CM-31-SL0001(6-8)	990610-CM-31-SL0002(2-4)	990610-CM-31-SL0002(4-6)	990610-CM-31-SL0002(8-10)
Lab ID	Industrial [1/]		109054-4	109054-5	109054-6	109054-7	109054-8	109054-9
Sample Date			6/10/1999	6/10/1999	6/10/1999	6/10/1999	6/10/1999	6/10/1999
Cyanide, Total (mg/kg):	41,000	NS	<0.25	<0.25	<0.24	<0.24	<0.24	<0.27

Footnotes:
NS No Standard.
J Positive results have been classified as qualitative during data validation.
UJ Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
R Data classified as unusable.
ug/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
1/ Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/ RBC for Chromium VI.
3/ Residential RBC.
4/ TC Levels for VOCs and SVOCs are in micrograms per liter (ug/L) and metals are in milligrams per liter (mg/L).
[ ] Concentration exceeds Industrial RBC.

TABLE 3-5
Summary of Constituents Detected in Subsurface Soil Samples Collected at SWMU 36 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

			36-SB0001			
Sample ID	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990611-CM-36-SL0001(4-6)	990611-CM-36-SL0001(6-8)	990611-CM-36-SL9001	990611-CM-36-SL0001(8-10)
Lab ID			109119-2	109119-1	109119-9	109119-3
Sample Date			6/11/1999	6/11/1999	6/11/1999	6/11/1999
Semivolatile Organic Compounds (ug/kg):						
Bis(2-ethylhexyl)phthalate	410,000	NS	<400	670	<420	<430
Metals (mg/kg):						
Arsenic, Total	3.8	5	5.6	6.3	6	6.7
Barium, Total	140,000	100	16 J	25 J	26 J	11 J
Beryllium, Total	4,100	NS	<0.06 R	0.24 J	0.16 J	0.11 J
Cadmium, Total	1,000	1	0.9 J	0.4 J	0.57 J	0.11 J
Chromium, Total [2/]	6,100	5	11 J	5.8 J	5.8 J	1.7 J
Copper, Total	82,000	NS	0.57 J	0.63 J	1.6 J	1.5 J
Lead, Total [3/]	400	5	10 J	9.9 J	7.1 J	1.8 J
Nickel, Total	41,000	NS	2.4 J	2.6 J	2.7 J	1.5 J
Selenium, Total	10,000	1	0.15 J	<0.12 UJ	0.14 UJ	<4 UJ
Thallium, Total	140	NS	0.14	0.36	0.34	0.14
Zinc, Total	610,000	NS	5.2 UJ	3.1 UJ	4.3 UJ	2.6 UJ
Cyanide, Total (mg/kg):	41,000	NS	<0.24	<0.26	<0.26	<0.26

Footnotes:

J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
R	Data classified as unusable.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/	RBC for Chromium VI.
3/	Residential RBC.
4/	TC Levels for SVOCs are in micrograms per liter (ug/L) and for metals are in milligrams per liter (mg/L).
[box]	Concentration exceeds Industrial RBC.

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TABLE 3-6
Summary of Constituents Detected in Investigation
Derived Waste Rock and Soil Samples Collected in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

	Sample ID Lab ID Sample Date	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990621-BT-IW-SL0000 109428-12 6/21/1999	990621-BT-IW-SL0038 109428-8 6/21/1999	990621-BT-IW-SL0039 109428-9 6/21/1999	990621-BT-IW-SL0040 109428-10 6/21/1999
	Volatile Organic Compounds (ug/kg):						
	Benzene	200,000	500	<400	<300	<370	<350
	Chlorobenzene	41,000,000	100,000	480	<300	<370	<350
	Toluene	410,000,000	NS	2800	<120	<150	<140
	Xylenes	4,100,000,000	NS	<400	<300	<370	<350
	Semivolatile Organic Compounds (ug/kg):						
*	2-Methylnaphthalene	41,000,000.00	NS	<530	690	<490	<460
*	Acenaphthene	############	NS	680	520	<490	550
*	Acenaphthylene	NS	NS	<530	<400	<490	790
*	Anthracene	610,000,000	NS	840	530	<490	2300
*	Benzo(a)anthracene	7,800	NS	1800	<400	550	3700
*	Benzo(a)pyrene	780	NS	$\boxed{2200}$	<400	<490	$\boxed{5500}$
*	Benzo(b)fluoranthene	7,800	NS	2700	420	<490	4600
*	Benzo(g,h,i)perylene	NS	NS	<530	<400	<490	1200
*	Benzo(k)fluoranthene	78,000	NS	3100	470	600	4500
	Bis(2-ethylhexyl)phthalate	410,000	NS	4200	<400	<490	<460
*	Chrysene	780,000	NS	2100	<400	500	4600
*	Dibenzo(a,h)anthracene	780	NS	<530	<400	<490	<460
	Dibenzofuran	8,200,000	NS	<530	540	<490	480
*	Fluoranthene	82,000,000	NS	7800	2200	1500	17000
*	Fluorene	82,000,000	NS	880	900	<490	1400
*	Indeno(1,2,3-cd)pyrene	7,800	NS	<530	<400	<490	1300
*	Naphthalene	41,000,000	NS	1400	3700	<490	830
*	Phenanthrene	NS	NS	5000	2500	960	11000
*	Pyrene	61,000,000	NS	3500	1200	820	9300

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TABLE 3-6
Summary of Constituents Detected in Investigation
Derived Waste Rock and Soil Samples Collected in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Sample ID / Lab ID / Sample Date	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990621-BT-IW-SL0000 109428-12 6/21/1999	990621-BT-IW-SL0038 109428-8 6/21/1999	990621-BT-IW-SL0039 109428-9 6/21/1999	990621-BT-IW-SL0040 109428-10 6/21/1999
Metals (mg/kg):						
Arsenic, Total	3.8	5	$\boxed{7}$	3.1	$\boxed{5}$	$\boxed{5.4}$
Barium, Total	140,000	100	63 J	24 J	17 J	22 J
Cadmium, Total	1,000	1	2.9	2.5	2.2	2.4
Chromium, Total [2/]	6,100	5	18	16	11	14
Copper, Total	82,000	NS	16	6	5.8	5.5
Lead, Total [3/]	400	5	18	4.3	6.8	5.7
Mercury, Total [5/]	200	0	<0.4 UJ	<0.3 UJ	<0.37 UJ	<0.35 UJ
Nickel, Total	41,000	NS	10	4.7	4.8	5.7
Thallium, Total	140	NS	<0.16	<0.23	<0.14	<0.13
Zinc, Total	610,000	NS	63	24 U	35 U	29 U
Cyanide, Total (mg/kg):	41,000	NS	1.9	0.38	0.37	<0.28

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TABLE 3-6
Summary of Constituents Detected in Investigation
Derived Waste Rock and Soil Samples Collected in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Sample ID Lab ID Sample Date	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990621-BT-IW-SL0041 109428-7 6/21/1999	990621-BT-IW-SL0042 109428-6 6/21/1999	990621-BT-IW-SL0043 109428-5 6/21/1999	990621-BT-IW-SL0044 109428-11 6/21/1999
Volatile Organic Compounds (ug/kg):						
Benzene	200,000	500	<330	<280	<300	<300
Chlorobenzene	41,000,000	100,000	<330	<280	<300	<300
Toluene	410,000,000	NS	250	<110	<120	<120
Xylenes	4,100,000,000	NS	680	<280	<300	<300
Semivolatile Organic Compounds (ug/kg):						
* 2-Methylnaphthalene	41,000,000.00	NS	24000	<380	<400	<400
* Acenaphthene	############	NS	22000	<380	<400	<400
* Acenaphthylene	NS	NS	1300	<380	<400	<400
* Anthracene	610,000,000	NS	6400	<380	530	<400
* Benzo(a)anthracene	7,800	NS	13000	<380	1100	<400
* Benzo(a)pyrene	780	NS	13000	450	1700	<400
* Benzo(b)fluoranthene	7,800	NS	9700	470	1900	<400
* Benzo(g,h,i)perylene	NS	NS	3000	<380	600	<400
* Benzo(k)fluoranthene	78,000	NS	14000	400	1400	<400
Bis(2-ethylhexyl)phthalate	410,000	NS	<430	<380	<400	<400
* Chrysene	780,000	NS	12000	410	1300	<400
* Dibenzo(a,h)anthracene	780	NS	<430	<380	<400	<400
Dibenzofuran	8,200,000	NS	13000	<380	<400	<400
* Fluoranthene	82,000,000	NS	38000	1100	4600	440
* Fluorene	82,000,000	NS	22000	<380	<400	<400
* Indeno(1,2,3-cd)pyrene	7,800	NS	3400	<380	580	<400
* Naphthalene	41,000,000	NS	82000	<380	<400	<400
* Phenanthrene	NS	NS	49000	550	2200	<400
* Pyrene	61,000,000	NS	21000	670	2500	<400

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TABLE 3-6
Summary of Constituents Detected in Investigation
Derived Waste Rock and Soil Samples Collected in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Sample ID / Lab ID / Sample Date	USEPA RBC Soil Ingestion Industrial [1/]	RCRA TC Level [4/]	990621-BT-IW-SL0041 / 109428-7 / 6/21/1999	990621-BT-IW-SL0042 / 109428-6 / 6/21/1999	990621-BT-IW-SL0043 / 109428-5 / 6/21/1999	990621-BT-IW-SL0044 / 109428-11 / 6/21/1999
Metals (mg/kg):						
Arsenic, Total	3.8	5	$\boxed{9.6}$	2.6	$\boxed{15}$	$\boxed{4.9}$
Barium, Total	140,000	100	500 J	43 J	110 J	37 J
Cadmium, Total	1,000	1	2.5	1	1.2	5.3
Chromium, Total [2/]	6,100	5	15	3.8	3.9	21
Copper, Total	82,000	NS	20	5.9	13	12
Lead, Total [3/]	400	5	35	<2.8	13	36
Mercury, Total [5/]	200	0	1 J	<0.28 UJ	<0.3 UJ	<0.3 UJ
Nickel, Total	41,000	NS	12	5.2	4.7	7.7
Thallium, Total	140	NS	<0.12	<0.1	0.17	<0.22
Zinc, Total	610,000	NS	89	23 U	17 U	230
Cyanide, Total (mg/kg):	41,000	NS	4.2	<0.23	0.33	1.2

Footnotes:

NS	No Standard
J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 27, 1999.
2/	RBC for Chromium VI.
3/	Residential RBC.
4/	TC Levels for VOCs and SVOCs are in micrograms per liter (ug/L) and metals are in milligrams per liter (mg/L).
5/	Methylmercury RBC.
*	Polycyclic aromatic hydrocarbon compound.
$\boxed{}$	Concentration exceeds Industrial RBC.

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TABLE 3-7
Summary of Constituents Detected in Groundwater
Samples Collected at SWMUs 13 and 21 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Chemical	USEPA MCL	RCRA TC Level	990621-BT-13-GW0038	990621-BT-13-GW0039	990618-BT-13-GW0040	990617-BT-13-GW0041
Lab Sample ID			109428-2	109428-3	109390-1	109373-1
Sample Date			6/21/1999	6/21/1999	6/18/1999	6/17/1999
Volatile Organic Compounds (ug/L):						
Benzene	5	500	12	<5	16	<5
Carbon disulfide	1000 1/	NS	6	<5	<5	<5
Chlorobenzene	100	100000	<5	<5	19	<5
Toluene	1000	NS	2	<2	12	<2
Xylenes	10000	NS	14	<5	<5	<5
Semivolatile Organic Compounds (ug/L):						
1,2,4-Trichlorobenzene	70	NS	<10	<10	12	<10
* 2-Methylnaphthalene	120 1/	NS	16	<10	15	33
* Acenaphthene	370 1/	NS	<10	<10	15	39
* Anthracene	1800 1/	NS	<10	<10	<10	25
* Benzo(a)anthracene	0.092 1/	NS	<10	<10	<10	23
* Benzo(a)pyrene	0.2	NS	<10	<10	<10	29
* Benzo(b)fluoranthene	0.092 1/	NS	<10	<10	<10	23
* Benzo(g,h,i)perylene	NS	NS	<10	<10	<10	13
* Benzo(k)fluoranthene	0.92 1/	NS	<10	<10	<10	21
Bis(2-ethylhexyl)phthalate	6	NS	<10	<10	<10	<10
* Chrysene	9.2 1/	NS	<10	<10	<10	26
Dibenzofuran	24 1/	NS	<10	<10	<10	17
* Fluoranthene	1500 1/	NS	<10	<10	11	140
* Fluorene	240 1/	NS	<10	<10	10	31
* Indeno(1,2,3-cd)pyrene	0.092 1/	NS	<10	<10	<10	15
* Naphthalene	6.5 1/	NS	420	17	98	84 J
* Phenanthrene	NS	NS	<10	<10	23	120
* Pyrene	180 1/	NS	<10	<10	<10	69

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TABLE 3-7
Summary of Constituents Detected in Groundwater
Samples Collected at SWMUs 13 and 21 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Chemical	USEPA MCL	RCRA TC Level	990621-BT-13-GW0038	990621-BT-13-GW0039	990618-BT-13-GW0040	990617-BT-13-GW0041
Lab Sample ID			109428-2	109428-3	109390-1	109373-1
Sample Date			6/21/1999	6/21/1999	6/18/1999	6/17/1999
Metals (mg/L):						
Arsenic, Total	0.05	5	<0.01	<0.01	<0.01	<0.01
Barium, Total	2	100	0.22	0.2	0.09	0.2
Chromium, Total	0.1	5	<0.01	0.02	<0.01	<0.01
Copper, Total	1.3	NS	<0.02	0.05	<0.02	0.02
Lead, Total	0.015	5	<0.015	0.02	<0.015	0.028
Mercury, Total	0.002	0.2	<0.0005	<0.0005	<0.0005	0.002
Zinc, Total	5	NS	0.32 U	0.24 U	0.09 U	0.17 U
Cyanide, Total (mg/L):	0.2	NS	0.06	<0.02	<0.02	0.26

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TABLE 3-7
Summary of Constituents Detected in Groundwater
Samples Collected at SWMUs 13 and 21 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Chemical	USEPA MCL	RCRA TC Level	990617-BT-13-GW9041	990617-BT-13-GW0042	990617-BT-13-GW0043	990621-BT-13-GW0044
Lab Sample ID			109373-4	109373-2	109373-3	109428-1
Sample Date			6/17/1999	6/17/1999	6/17/1999	6/21/1999
Volatile Organic Compounds (ug/L):						
Benzene	5	500	6	<5	<5	<5
Carbon disulfide	1000 [1/]	NS	<5	<5	<5	<5
Chlorobenzene	100	100000	<5	<5	<5	<5
Toluene	1000	NS	<2	<2	<2	<2
Xylenes	10000	NS	<5	<5	<5	<5
Semivolatile Organic Compounds (ug/L):						
1,2,4-Trichlorobenzene	70	NS	<10	<10	<10	<10
* 2-Methylnaphthalene	120 [1/]	NS	29	<10	<10	<10
* Acenaphthene	370 [1/]	NS	36	<10	<10	<10
* Anthracene	1800 [1/]	NS	25	<10	<10	<10
* Benzo(a)anthracene	0.092 [1/]	NS	23	<10	<10	<10
* Benzo(a)pyrene	0.2	NS	28	<10	<10	<10
* Benzo(b)fluoranthene	0.092 [1/]	NS	23	<10	<10	<10
* Benzo(g,h,i)perylene	NS	NS	14	<10	<10	<10
* Benzo(k)fluoranthene	0.92 [1/]	NS	29	<10	<10	<10
Bis(2-ethylhexyl)phthalate	6	NS	<10	<10	<10	<10
* Chrysene	9.2 [1/]	NS	25	<10	<10	<10
Dibenzofuran	24 [1/]	NS	16	<10	<10	<10
* Fluoranthene	1500 [1/]	NS	140	<10	<10	<10
* Fluorene	240 [1/]	NS	30	<10	<10	<10
* Indeno(1,2,3-cd)pyrene	0.092 [1/]	NS	14	<10	<10	<10
* Naphthalene	6.5 [1/]	NS	65 J	<10	<10	<10
* Phenanthrene	NS	NS	120	<10	<10	<10
* Pyrene	180 [1/]	NS	73	<10	<10	<10

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TABLE 3-7
Summary of Constituents Detected in Groundwater
Samples Collected at SWMUs 13 and 21 in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Chemical	USEPA MCL	RCRA TC Level	990617-BT-13-GW9041	990617-BT-13-GW0042	990617-BT-13-GW0043	990621-BT-13-GW0044
Lab Sample ID			109373-4	109373-2	109373-3	109428-1
Sample Date			6/17/1999	6/17/1999	6/17/1999	6/21/1999
Metals (mg/L):						
Arsenic, Total	0.05	5	<0.01	0.01	0.01	<0.01
Barium, Total	2	100	0.19	0.22	0.12	0.22
Chromium, Total	0.1	5	<0.01	<0.01	<0.01	<0.01
Copper, Total	1.3	NS	<0.02	0.02	<0.02	<0.02
Lead, Total	0.015	5	0.023	<0.015	<0.015	<0.015
Mercury, Total	0.002	0.2	0.001	<0.0005	<0.0005	<0.0005
Zinc, Total	5	NS	0.12 U	0.1 U	0.07 U	0.07 U
Cyanide, Total (mg/L):	0.2	NS	0.25	0.12	<0.02	0.04

Explanation:
ug/L - Micrograms per liter.
mg/L - Milligrams per liter.
MCL - Primary Maximum Contaminant Level.
[1/] - USEPA Region III Risk Based Concentrations for Tap Water, October 27, 1999.
Concentration exceeds USEPA MCL and USEPA Tap Water RBC.
* - Polycyclic Aromatic Hydrocarbon Compound.
NS - No Standard.

TABLE 3-8
Summary of Groundwater Resampling Data Collected from P-13S, P-13D,
P-15, MW-26, MW-32, MW-34S, and MW-34D in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corp.

Sample ID Sample Date	USEPA MCL	RCRA TC Level 4/	990618-CM-00- GW00P13D 6/18/1999	990618-CM-00- GW00P13S 6/18/1999	990619-FW-00- GW00P15 6/19/1999	990619-LD-38- GW0026 6/19/1999
<u>Volatile Organic Compounds (ug/L):</u>						
Benzene	5	500	<5	120	<5	14
Ethylbenzene	700	NS	<5	<5	<5	5
Toluene	1,000	NS	3	<2	<2	26
Vinyl chloride	2	200	18	41	<1	<1
Xylenes	10,000	NS	<5	<5	<5	29
	s					
Cyanide, Total (mg/L):	0.2	NS	NA	NA	NA	NA

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TABLE 3-8
Summary of Groundwater Resampling Data Collected from P-13S, P-13D,
P-15, MW-26, MW-32, MW-34S, and MW-34D in June 1999
Chemical Manufacturing Plant RFI
Sloss Industries Corp.

Sample ID Sample Date	USEPA MCL	RCRA TC Level 4/	990619-LD-39- GW0032 6/19/1999	990618-LD-39- GW0034D 6/18/1999	990618-LD-39- GW0034S 6/18/1999
Volatile Organic Compounds (ug/L):					
Benzene	5	500	NA	<5	NA
Ethylbenzene	700	NS	NA	<5	NA
Toluene	1,000	NS	NA	<2	NA
Vinyl chloride	2	200	NA	<1	NA
Xylenes	10,000	NS	NA	<5	NA
	s				
Cyanide, Total (mg/L):	0.2	NS	0.36	NA	0.17

Explanation:
MCL - Primary Maximum Contaminant Level.
ug/L - Micrograms per liter.
mg/L - Milligrams per liter
NA - Not analyzed
[box] Concentration exceeds EPA MCL.

TABLE 3-9
IDW Soil Cuttings Characterization
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

SWMU	Location Name	Sample ID	Number of Drums	Characterization: Concentration May Exceed RCRA TC Level	Characterization: Concentration Exceeds USEPA RBC for Industrial Ingestion or Background Soil Range for Arsenic	Characterization: Concentration Does Not Exceed USEPA RBC for Industrial Ingestion or Background Soil Range for Arsenic	Proposed Management Practice: Dispose of as Hazardous Waste	Proposed Management Practice: Dispose of as Contaminated Medium	Proposed Management Practice: Place Cuttings in Land Disposal Area at Sloss
26	26-SB0001	990609-CM-26-SL0001(5-7)	1	x			x		
		990609-CM-26-SL0001(9-11)		x	x				
		990609-CM-26-SL0001(13-15)				x			
	26-SB0002	990609-CM-26-SL0002(2-4)	1			x			x
		990609-CM-26-SL0002(4-6)				x			
		990609-CM-26-SL0002(6-8)				x			
27	27-SB0001	990610-CM-27-SL0001(2-4)	1			x			x
		990610-CM-27-SL0001(6-8)				x			
		990610-CM-27-SL0001(10-12)				x			
	27-SB0002	990611-CM-27-SL0002(3-5)	1			x	x		
		990611-CM-27-SL0002(5-7)		x					
		990611-CM-27-SL0002(9-11)				x			
29	29-SB0001	990609-CM-29-SL0001(4-6)	1			x			x
		990609-CM-29-SL9001				x			
		990609-CM-29-SL0001(8-10)				x			
		990609-CM-29-SL0001(12-13)				x			
	29-SB0002	990609-CM-29-SL0002(4-4.5)	1			x			x
31	31-SB0001	990610-CM-31-SL0001(0.5-2)	1			x			x
		990610-CM-31-SL0001(2-4)				x			
		990610-CM-31-SL0001(6-8)				x			
	31-SB0002	990610-CM-31-SL0002(2-4)	1			x			x
		990610-CM-31-SL0002(4-6)				x			
		990610-CM-31-SL0002(8-10)				x			
36	36-SB0001	990611-CM-36-SL0001(4-6)	1			x			x
		990611-CM-36-SL9001				x			
		990611-CM-36-SL0001(6-8)				x			
		990611-CM-36-SL0001(8-10)				x			

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TABLE 3-10
IDW Rock and Soil Cuttings Characterization
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Drum ID	Sample ID	Number of Drums	Cutting Material	Characterization			Proposed Management Practice		
				Concentration May Exceed RCRA TC Level	Concentration Exceeds USEPA RBC for Industrial Ingestion or Background Soil Range for Arsenic	Concentration Does Not Exceed USEPA RBC for Industrial Ingestion or Background Soil Range for Arsenic	Dispose of as Hazardous Waste	Dispose of as Contaminated Medium	Place Cuttings in Land Disposal Area at Sloss
MW-38	990621-BT-IW-SL0038	4	Rock, CL			x			x
MW-39	990621-BT-IW-SL0039	3	Rock, CL			x			x
MW-40/MW-38	990621-BT-IW-SL0040	3	Rock, CL		x			x	
	990621-BT-IW-SL0038					x			
MW-41	990621-BT-IW-SL0041	1	Rock, CL		x			x	
MW-42	990621-BT-IW-SL0042	1	Rock, CL			x			x
MW-43	990621-BT-IW-SL0043	1	Rock, CL		x			x	
MW-44	990621-BT-IW-SL0044	5	Rock, CL			x			x
Decon Pad Cuttings	990621-BT-IW-SL0000	1	Rock, CL		x			x	
Decon Pad Materials	990621-BT-IW-SL0000	4	Plastic, Cuttings		x			x	

TABLE 3-11
IDW Purge Water Characterization
Chemical Manufacturing Plant RFI
Sloss Industries Corporation

Drum ID	**Sample ID**	Number of Drums	Characterization Concentration Exceeds USEPA MCL or RBC for Tap Water	Concentration Does Not Exceed USEPA MCL or RBC for Tap	Proposed Management Practice Dispose of as Hazardous Waste	Dispose of as Contaminated Medium	Dispose of Purge Water at BTF
MW-38	990621-BT-13-GW0038	1	x			x	
MW-39	990621-BT-13-GW0039	1	x			x	
MW-40	990618-BT-13-GW0040	1	x			x	
MW-41	990617-BT-13-GW0041	1	x			x	
MW-42	990617-BT-13-GW0042	1		x			x
MW-43	990617-BT-13-GW0043	1		x			x
MW-44	990621-BT-13-GW0044	2		x			x
MW-41,	990617-BT-13-GW0041	1	x			x	
MW-42 &	990617-BT-13-GW0042			x			
MW-43	990717-BT-13-GW0043			x			
P-13D &	990618-CM-00-GW00P13D	1	x			x	
MW-34D	990618-LD-39-GW0034D			x			
P-13S &	990618-CM-00-GW00P13S	1	x			x	
MW-34S	990618-LD-39-GW0034S			x			
MW-32	990619-LD-39-GW0032	1	x			x	
MW-38,	990621-BT-13-GW0038	1	x			x	
MW-39,	990621-BT-13-GW0039		x				
MW-26, &	990619-LD-38-GW0026		x				
P-15	990619-FW-00-GW00P15			x			

ARCADIS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

MEMORANDUM

DATE: DEC 2 8 1992

SUBJECT: Guidance Number TSC-92-02
Management of Contaminated Media

FROM: G. Alan Farmer
Chief, RCRA Branch
Alan Farmer

TO: Addressees

Attached please final guidance developed by the EPA Region IV RCRA Technical Screening Committee regarding management of contaminated groundwater, surface water and soils. This guidance expands upon the existing "contained-in" policy and also addresses management of environmental media exhibiting a hazardous characteristic.

This guidance should be followed by EPA Region IV staff and all others who actively manage contaminated environmental media within Region IV during any of the following RCRA activities:

- Corrective actions;
- Site investigations;
- Clean up of hazardous waste spills, and
- Closure of RCRA treatment, storage or disposal units.

In addition, this guidance represents an interpretation of RCRA regulations and as such should be considered in evaluating ARARs for CERCLA activities.

The Technical Screening Committee would like to thank everyone who commented on the draft for their contributions to the guidance.

Attachment

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EPA REGION IV RCRA GUIDANCE:
MANAGEMENT OF CONTAMINATED MEDIA
Guidance Number TSC-92-02
August 1992

I. Introduction

On several previous occasions, EPA has issued directives and guidance addressing the regulatory status and proper disposition of contaminated environmental media under the Resource Conservation and Recovery Act (RCRA). However, Region IV continues to receive inquiries from the States and the regulated community requesting more detailed guidance on this subject. This document explains how to properly manage contaminated environmental media (i.e., groundwater, surface water, soils and sediments) during routine field work at hazardous waste sites.

It is important to emphasize that this guidance is only intended to be an interpretation of RCRA regulations. Nothing in this guidance is intended to change or supersede actual RCRA regulatory requirements. Several anticipated rulemakings relate to this guidance, including the Land Disposal Restrictions for Contaminated Soil and Debris and the Hazardous Waste Identification Rule. If any provisions of these future RCRA regulations are in conflict with this guidance, the regulations (once final) will take precedent. 1/

II. Scope and Applicability

This guidance sets forth procedures for the proper management of contaminated environmental media produced and/or managed during the investigation and remediation of hazardous waste sites. Contaminated media should be managed in accordance with this guidance whenever hazardous constituents are present above levels of human health or environmental concern.

This guidance applies to contaminated media generated during the following RCRA activities:

1. corrective actions;
2. site investigations;
3. clean up of spills of listed or characteristic hazardous waste; and
4. closure of RCRA treatment, storage, or disposal units.

1/ The policies and procedures established in this document are intended solely for the guidance of employees of the U.S. Environmental Protection Agency. They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the the United States. EPA reserves the right to act at variance with these policies and procedures and to change them at any time without public notice.

The procedures and management practices set forth in this guidance should be followed by EPA Region IV and all others who actively manage contaminated media at sites within the Region, regardless of whether such management activities are voluntary or carried out in response to EPA regulations or directives.

III. Background

The regulatory status of contaminated groundwater was first specifically addressed in a December 26, 1984, memorandum from John Skinner, Director of the Office of Solid Waste to James Scarbrough, Region IV Residuals Management Branch Chief. In that memorandum, Skinner noted that contaminated groundwater that is "collected" and derived from listed wastes or hazardous by characteristic is a hazardous waste and subject to Subtitle C regulations.

A November 13, 1986, memorandum from Marcia Williams, Director of the Office of Solid Waste to Patrick Tobin, Region IV Waste Management Division Director attempted to more precisely explain the EPA position on contaminated groundwater presented by Skinner. The Williams memorandum explained what is now referred to as the "contained-in" policy. Williams stated that groundwater in an aquifer is not a solid waste and thus not a hazardous waste, but that groundwater contaminated with hazardous waste leachate is subject to RCRA Subtitle C regulations because it "contains" a hazardous waste and therefore must be managed as if the groundwater itself was hazardous. However, if groundwater is treated such that it no longer contains a hazardous waste, the groundwater would no longer be subject to regulation under Subtitle C of RCRA.

Subsequent to the 1986 Williams memorandum, the scope of the "contained-in" policy has been applied to contaminated soil, debris, and leachate. For example, in the Land Disposal Restrictions (LDR) First Third Final Rule (53 FR 31142) the Agency clarified the applicability of the LDR treatment standards to residues from types of management other than treatment. 2/ Examples cited by EPA are contaminated soil or leachate derived from managing the waste. EPA stated: "In these cases, the mixture is deemed to be the listed waste, either because of the derived-from rule, the mixture rule (40 CFR §261.3(a)(2)(iv)), or because the listed waste is contained in the matrix...". 3/

2/: Residuals from treatment of listed hazardous waste have always been considered hazardous waste by application of the derived-from rule (40 CFR §261.3(c)(2)(i)).

3/. The reference to contaminated soil and leachate as "the mixture" does not mean that contaminated medium is considered hazardous waste by application of the mixture rule. However, the contained-in policy is, in fact, analogous to the mixture rule, involving mixtures of hazardous

(continued. . .)

In a June 19, 1989, letter to Thomas C. Jorling, Commissioner of the New York Department of Environmental Conservation from Jonathan Cannon, Acting Assistant Administrator, EPA reiterated the basis for EPA's authority to regulate contaminated environmental media under Subtitle C of RCRA. Referring to the "mixture" rule and "derived-from" rule, Cannon states

> ...However, these two rules do not pertain to contaminated environmental media. Under our regulations, contaminated media are not considered solid wastes in the sense of being abandoned, recycled, or inherently waste-like as those terms are defined in the regulations. Therefore, contaminated environmental media cannot be considered a hazardous waste via the "mixture" rule (i.e., to have a hazardous waste mixture, a hazardous waste must be mixed with a solid waste per 40 CFR §261.3(a)(2)(iv)). Similarly, the "derived-from" rule does not apply to contaminated media. Our basis for stating that contaminated environmental media must be managed as hazardous waste is that they "contain" listed hazardous waste. These environmental media must be managed as hazardous waste because and only so long as, they "contain" a listed hazardous waste (i.e., until decontaminated).

IV. Regional Interpretation

All currently available EPA policy pertains to environmental media known to be contaminated with a listed hazardous waste. These documents collectively make up the "contained-in" policy. However, the "contained-in" policy does not address contamination from characteristic hazardous waste. Furthermore, in practice there are many times where there is no clear documentation that an environmental medium was contaminated by either a listed or characteristic hazardous waste (as is often the case at solid waste management units). Because we routinely encounter contaminated media situations beyond the scope of the traditional "contained-in" policy, it is appropriate to clarify by establishing a general definition of "contaminated" media.

EPA Region IV has established that the criteria used to determine if media requires controlled management is based upon human health and environmental risk. By definition a medium is "contaminated" if one or more hazardous constituents, as identified in 40 CFR Part 261 Appendix VIII, are present above levels of human health or environmental concern and above naturally occurring (background) levels (this is specifically for areas where there are naturally occurring high levels of Appendix VIII constituents). Contaminated environmental media should either be managed in accordance with RCRA Subtitle C requirements or "best management

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3/(continued. . .)

waste and non-waste materials while the mixture rule governs mixtures of hazardous and solid waste. The mixture rule has been codified, but the interpretive contained-in policy has the same regulatory effect. The interpretation that media containing hazardous waste must be regulated as hazardous waste was upheld in Chemical Waste Management v. U.S. EPA, 869 F.2d 1526, 1540 (D.C. Cir. 1989).

practices" as specified in Section V of this guidance. However, if a contaminated medium is treated to at or below risk-based standards (or to naturally occurring background levels), it can be rendered "decontaminated."

Risk-based levels for hazardous constituents should be derived on a site-specific basis with the aid of a toxicologist (and an ecologist, where appropriate). It is not possible or appropriate for the Region to establish generic "de minimis" levels for constituents absent a new rulemaking. Human health protection limits should be calculated using reference toxicity values for cancer and noncancer effects (i.e., carcinogenic potency factors (CPFs) and reference doses (RfDs), respectively), and exposure rate and route assumptions appropriate to site conditions. Consideration of contaminant attenuation is not an appropriate substitute for direct exposure assumptions in determining decontamination levels for environmental media. This is because a decontaminated medium under this guidance is not subject to controlled management (as opposed to non-hazardous or delisted solid waste, which under Subtitle D of RCRA remains subject to regulatory control). However, consideration of fate and transport for possible leaching to groundwater is necessary to ensure that a contaminated soil is treated to below risk-based standards for all exposure pathways. The RCRA RFI Guidance and the CERCLA Risk Assessment Guidance (RAG) should be consulted for further explanation on risk evaluations.

Once an environmental medium is determined to be "contaminated", knowledge of how the medium became contaminated dictates how that medium must be managed. The attached decision matrix is provided to assist the user in making the correct regulatory decision for management of contaminated media. A contaminated medium must ultimately be managed one of two ways: 1) as if it were a hazardous waste, or 2) in accordance with "best management practices." The discussion below explains the decision matrix logic.

A medium contaminated by listed hazardous waste clearly falls within the scope of the "contained-in" policy (Step 1 on the decision matrix). As established in Section III, the listed hazardous waste is "contained-in" the medium. The P- and U- waste listings represent a special situation whereby contaminated media are listed hazardous wastes. As stated in 40 CFR §261.33(d):

> Any residues or contaminated soil, water or other debris resulting from the cleanup of a spill into or on the land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill, into or on the land of any off-specification chemical product and would have the generic name listed in paragraph (e) or (f) of this section.

These contaminated media are P- and U-listed hazardous wastes and are subject to all RCRA requirements. Although contaminated soil, water or other debris are considered hazardous wastes under this listing, if they are decontaminated, they no longer meet the listing and therefore are not a listed hazardous waste nor do they "contain" a listed hazardous waste.

Both contaminated media which are themselves listed hazardous wastes (P- and U-listed wastes) and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Once a medium is decontaminated such that it no longer is a listed hazardous waste (P- and U-listed wastes) or no longer "contains" the listed hazardous waste, then Subtitle C ceases to apply.

Another way in which media may become "contaminated" is through contact with a characteristic hazardous waste (Step 2 on the decision matrix). If it can be validated that the medium was not contaminated by a characteristic hazardous waste, then the medium may be managed in accordance with best management practices. However, if knowledge of the originating waste stream indicates that contamination did result from a characteristic hazardous waste, or if the source of contamination is unknown, then the medium must be tested to determine whether it exhibits a hazardous waste characteristic (Step 3 on the decision matrix).

Any medium exhibiting a hazardous waste characteristic must be managed in accordance with Subtitle C regulations until it no longer exhibits the characteristic. If the medium is found not to exhibit a hazardous characteristic but is still "contaminated", it must be managed according to best management practices.

In summary, there are two key points to note when using the decision matrix. Contaminated media which are themselves hazardous wastes (P- and U-listed wastes), media which exhibit a hazardous waste characteristic, and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices should be applied.

The management scenarios described above apply to a contaminated medium until such medium is decontaminated. Decontamination is required for all Appendix VIII constituents which are above health-based limits and background, not merely the Appendix VIII constituent for which the waste was listed or which caused the medium to exhibit a hazardous characteristic. All RCRA investigation and corrective action plans submitted to EPA Region IV for review and approval should include a sampling and analysis protocol for verifying that a medium has been decontaminated if treatment is to occur on-site. Sampling frequency for verifying decontamination will depend on a number of site-specific factors, such as the source of the contaminated medium, nature, extent and degree of contamination, and type of treatment. As an example, for small amounts of contaminated media (soil samples, drill cuttings, well purge water, etc.), testing of each drum or batch might provide adequate verification of decontamination. However, for large scale remediation of groundwater, periodic sampling might be appropriate. Chapter 9 of SW-846 provides more specific information regarding appropriate sampling procedures and frequencies.

A more detailed discussion of what "subject to Subtitle C regulations" means is provided in Section VI. Best management practices will be defined for each situation as part of the review process for sampling, investigation and corrective action plans. Some examples of best management practices are provided in Section V.B.

V. Management Procedures

This portion of the guidance contains several sub-sections which provide specific guidance for managing contaminated media under several common scenarios encountered at hazardous waste sites. This guidance provides the user with a high degree of flexibility to make site-specific management decisions. It also encourages the user to take full advantage of variances and exemptions provided for under RCRA.

A. RCRA Corrective Actions

Any contaminated medium containing a listed hazardous waste that is actively managed under a corrective action is subject to Subtitle C requirements. Any unit used for the treatment, storage, or disposal of such medium is also subject to Subtitle C requirements (see Section VI regarding applicability of Subtitle C requirements).

Any medium contaminated with a characteristic hazardous waste must be tested to determine if the medium exhibits any hazardous characteristics. If the medium does exhibit a hazardous characteristic, it is subject to Subtitle C requirements. Any unit used for the treatment, storage, or disposal of such medium is also subject to Subtitle C. A medium that does not exhibit a characteristic, or is treated such that it does not exhibit a characteristic, but is by definition contaminated, is subject to best management practices, but is not subject to Subtitle C requirements.

Treatment of a contaminated medium, whether it is from a listed or characteristic hazardous waste, may yield a decontaminated medium component and one or more waste components. The decontaminated medium component is not subject to RCRA Subtitle C, but may be subject to State and Local requirements, RCRA Subtitle D, and best management practices. The waste component is subject to RCRA Subtitle C requirements if it exhibits a hazardous waste characteristic or resulted from treatment of media containing a listed hazardous waste. Otherwise, disposal of the waste component is subject to State and Local requirements.

For corrective action purposes, a "no action" alternative should not be selected for a medium that is considered "contaminated", because that medium is still a health and environmental hazard until it is decontaminated.

B. Site Investigation Residues

If it has been determined that the environmental medium to be sampled is itself a hazardous waste (P- and U-listed wastes), exhibits a hazardous waste characteristic or "contains" a listed hazardous waste, then Subtitle C requirements apply to the residues (purge water, drill cuttings, drilling fluids, etc.) that are generated during the sampling event. These residues must be containerized and/or treated and disposed in a manner that is in compliance with Subtitle C of RCRA.

An issue of particular concern is the applicability of land disposal restrictions (LDRs) to site investigation residues. "Land disposal" occurs when hazardous wastes (or contaminated media subject to Subtitle C) are consolidated from different units into one unit, when media are moved outside the unit (for treatment or storage) and returned to the unit, or when media are excavated, placed in a separate waste mangement unit (such as an incinerator or tank within the unit), and redeposited in the unit.

The Agency has developed guidance which addresses the applicability of RCRA LDRs to contaminated residues generated during Superfund site investigations. The CERCLA Guide to Management of Investigation-Derived Waste (OSWER Directive 9345.3-03fs) states that storing investigation-derived waste (IDW) in containers within the Area of Contamination (AOC), and then returning it to its source does not trigger LDR treatment standards as long as the containers are not managed in a such a manner as to constitute a "hazardous waste management unit" as defined in 40 CFR §260.10.[4/] In addition, sampling and direct replacement of wastes within an AOC do not constitute land disposal. It must be emphasized that direct replacement of contaminated media can only occur within an AOC. Contaminated residue outside of the AOC should be containerized and/or treated and disposed in compliance with Subtitle C of RCRA.

The proposed RCRA 40 CFR Part 264 Subpart S rules contain provisions for a corrective action management unit (CAMU), the RCRA analog to the CERCLA AOC. In an August 1992 guidance entitled "Use of the Corrective Management Unit Concept", EPA provided clarification regarding use of the CAMU concept prior to finalization of the

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4/ An April 16, 1991, memorandum from Caroline H. Wehling, Attorney, Solid Waste and Emergency Response, to Steven C. Golian, Chief, Remedial Guidance Section, establishes that EPA does not generally consider drums placed within a landfill to form "container storage areas". Thus, if waste is placed into drums which remain in the AOC and which are not placed into a separate storage or treatment area, such placement would not be considered a unit distinct from the landfill itself.

Subpart S regulations. In this guidance, the Regions were advised that the CAMU concept may be used in some situations to allow designation of an area of broad contamination as a single unit for purposes of determining what RCRA management standards apply. Thus, if the CAMU concept can be used in accordance with the August 1992 guidance to the same extent that the Agency describes a Superfund AOC, then the OSWER Directive 9345.3-03FS interpretation of what constitutes land disposal can also be applied to RCRA site investigation residues.

When sampling in areas or zones of suspected contamination where documentation does not exist to confirm that the contamination source was a listed hazardous waste, residues should be containerized until test results are available to determine whether the residue exhibits a characteristic. If the medium does not exhibit a hazardous waste characteristic, then Subtitle C regulations do not apply but the environmental sampling residues should still be managed in a manner that is protective of human health and the environment (i.e., best management practices). Best management practices should be followed any time that test results indicate residues contain hazardous constituents above a health or environmental based limit (but the residues do not exhibit a hazardous characteristic and the contamination source was not a listed waste). Best management practices suggest that contaminated sampling residues be treated or disposed in a unit that is operated in accordance with an environmental permit (e.g., NPDES, UIC, RCRA, or State solid waste management). If treatment or disposal in a permitted unit at the facility is not an available option, then the residues may be sent to an approved off-site facility for treatment or disposal. Alternatively, the residues may be stored in a secure location at the facility until the waste site under investigation is remediated. The residues should then be included in the remediation process.

It is recommended that the amount of residues generated during a sampling event be minimized (e.g., if possible, conduct pump tests in areas outside the plume of contamination). Residues that are not expected to be contaminated should not be mixed with contaminated residues (e.g., drill cuttings removed from above the water table in an area with no surface soil contamination should not be mixed with cuttings removed from below the water table).

All sampling plans that are submitted to the Region IV RCRA program for review and approval should contain procedures that detail how residues will be managed in compliance with this guidance.

C. Hazardous Waste Spills

EPA has developed a straightforward approach for assessing the regulatory status of spilled hazardous wastes. The approach is based on the premise that "a spill of hazardous material to soil or groundwater is normally a simple act of disposal" (55 FR 22671), or, put more simply, a spill constitutes disposal.

Under this approach, the spill of a hazardous waste constitutes "unpermitted" disposal of hazardous waste. The Agency recognizes the need for prompt action in response to a spill, and has provided that cleanup need not be done under a RCRA permit, provided it is done expeditiously and in an environmentally sound manner (see 40 CFR §264.1(g)(8) and 40 CFR §265.1(c)(11)).

EPA regulations have been promulgated for certain "spill" scenarios, due to the nature of certain kinds of waste. 40 CFR §261.33(d) identifies how the cleanup residues from a spill of P- and U-listed chemical products must be managed. In summary, it says that the residue or contaminated debris (including soil and water) from the cleanup of a spill of P- or U-listed chemical product is a hazardous waste when discarded (or when intended to be discarded). The residues from spills of F- and K-listed wastes and characteristic wastes should be managed in accordance with the procedures set forth in Section IV of this document.

When a spilled material is recycled or able to be recycled, the RCRA recycling regulations may exempt it from any other hazardous waste regulations. But the difficulty of recycling spill residues in such matrices as soil and groundwater indicates that a simple assertion of intent to recycle is not sufficient to claim a recycling exemption from regulation. Therefore, EPA asserts that the burden of proof for recycling remains on the generator.

In 55 FR 22671, EPA identifies five objective considerations for the regulator to apply in reviewing a recycling assertion, namely:

1. whether the generator has begun to recycle the spill;
2. the length of time the spill residue has existed;
3. the value of the spilled material;
4. whether it is technically feasible or practical to recycle the spill; and
5. whether there is any history of the company recycling this type of spill residue.

Other considerations may apply in site-specific cases.

D. RCRA Closures

In closing a RCRA regulated land-based unit, a facility has two options: "clean closure" or leaving the waste and waste residues in place and conducting post-closure care. To clean close, a facility must remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate.

The regulations are not clear regarding management of contaminated subsoils or other environmental media that are removed to achieve clean closure. Specifically, the closure regulations do not distinguish between contaminated media, which is not a solid waste, and other contaminated materials, which could be solid waste. The regulations at 40 CFR §§265.197, 265.228, 265.258, 265.280 and 265.310 (and the corresponding permit standards in 40 CFR Part 264) all state that removed contaminated soils [5] must be managed as a hazardous waste unless 40 CFR §261.3(d) applies. 40 CFR §261.3(d), which provides for delisting and demonstration of absence of hazardous waste characteristic, only refers to solid waste. Although soils and groundwater are not solid waste, the Region extends the provision for the demonstration of absence of characteristic in 40 CFR §261.3(d) to environmental media.

This interpretation is valid in that it is not appropriate to apply more stringent standards to environmental media than to solid wastes. In addition, although a contaminated medium is not itself a solid waste, the contamination within the medium is a solid waste and 40 CFR §261.3(d) clearly applies. Therefore, contaminated media from RCRA closures must be managed as if they are hazardous wastes and must meet Subtitle C requirements as long as they contain a listed waste or exhibit a hazardous waste characteristic. If a medium does not exhibit a hazardous waste characteristic, best management practices apply.

The treatment of a contaminated medium may yield a decontaminated medium component and one or more waste components. The decontaminated medium component is not subject to RCRA Subtitle C. The waste component remains subject to Subtitle C unless and until 40 CFR §261.3(d) applies.

VI. Subtitle C Requirements

Sections IV and V of this guidance define "contaminated" media and establish which categories of contaminated media are subject to Subtitle C requirements. In summary, Subtitle C requirements apply to active management of any medium which is itself a hazardous waste (P- and U-listed waste), any medium which "contains" a listed hazardous waste, and any medium which exhibits a hazardous waste characteristic.

It is not possible for one guidance to examine all of the Subtitle C requirements which might apply to management of contaminated media.

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[5] As clarified in 52 FR 8705, the Agency interprets the term "soil" broadly to include both unsaturated soils and soils containing groundwater. Uncontaminated groundwater is therefore a requirement for clean closure.

However, once the determination is made that the contaminated medium is subject to Subtitle C requirements, then the applicable Subtitle C requirements are the same as if that medium were in fact a hazardous waste. Thus, it is necessary to consider how the medium is being managed in determining which Subtitle C requirements would apply.

One of the most commonly asked questions is whether management of contaminated media requires a permit, especially if a contaminated medium is being managed as a result of corrective action under RCRA §3004(u), §3004(v) and §3008(h). To address this question, Region IV conducted a legal analysis of the RCRA regulations and corrective action legislative history. In summary, if the source of contamination renders media "subject to Subtitle C requirements" as explained in this guidance, and if the conduct of corrective action under RCRA §3004(u), §3004(v) or §3008(h) includes a storage, treatment or disposal activity that ordinarily requires a permit, such permit 6/ must be obtained. While this requirement will undoubtedly retard the corrective action process, it is inescapable absent rulemaking relief.

It is important to remember that RCRA Subtitle C standards include a number of waivers and conditional exemptions which can be applied to contaminated media (just as they are applied to hazardous waste). For example, if air stripping of contaminated groundwater occurs in a wastewater treatment unit subject to §402 or §307(b) of the Clean Water Act, and the unit also meets the RCRA definition of a tank or tank system, the treatment would not require a RCRA permit (40 CFR §264.1(g)(6)). Furthermore, the air stripping operation would not be subject to the Subpart AA air emission standards standards 7/ (55 FR 25456). As another example, 40 CFR §261.4(b)(10) exempts from the definition of hazardous waste petroleum-contaminated media and debris that fail the test for Toxicity Characteristic and are subject to corrective action regulations under 40 CFR Part 280. The user of this guidance is encouraged to take full advantage of these and all other RCRA waivers and exemptions to expedite corrective action.

VII. Decision Matrix for Management of Contaminated Media

A decision matrix has been provided to assist the user in making the correct regulatory decision for management of contaminated media. There are two key points to note when using the decision matrix. Contaminated

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6/ Depending on whether the facility already has permit or has interim status, a permit modification under 40 CFR §270.41 or 40 CFR §270.42, or change in interim status under 40 CFR §270.72 would be appropriate.

7/ Nevertheless, corrective action authorities should be used to ensure that the air emissions will not pose a threat to human health and the environment.

media which are themselves hazardous wastes (P- and U-listed wastes), and media which exhibit a hazardous waste characteristic or which "contain" a listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is a listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices may be applied.

VIII. Relation to CERCLA Activities

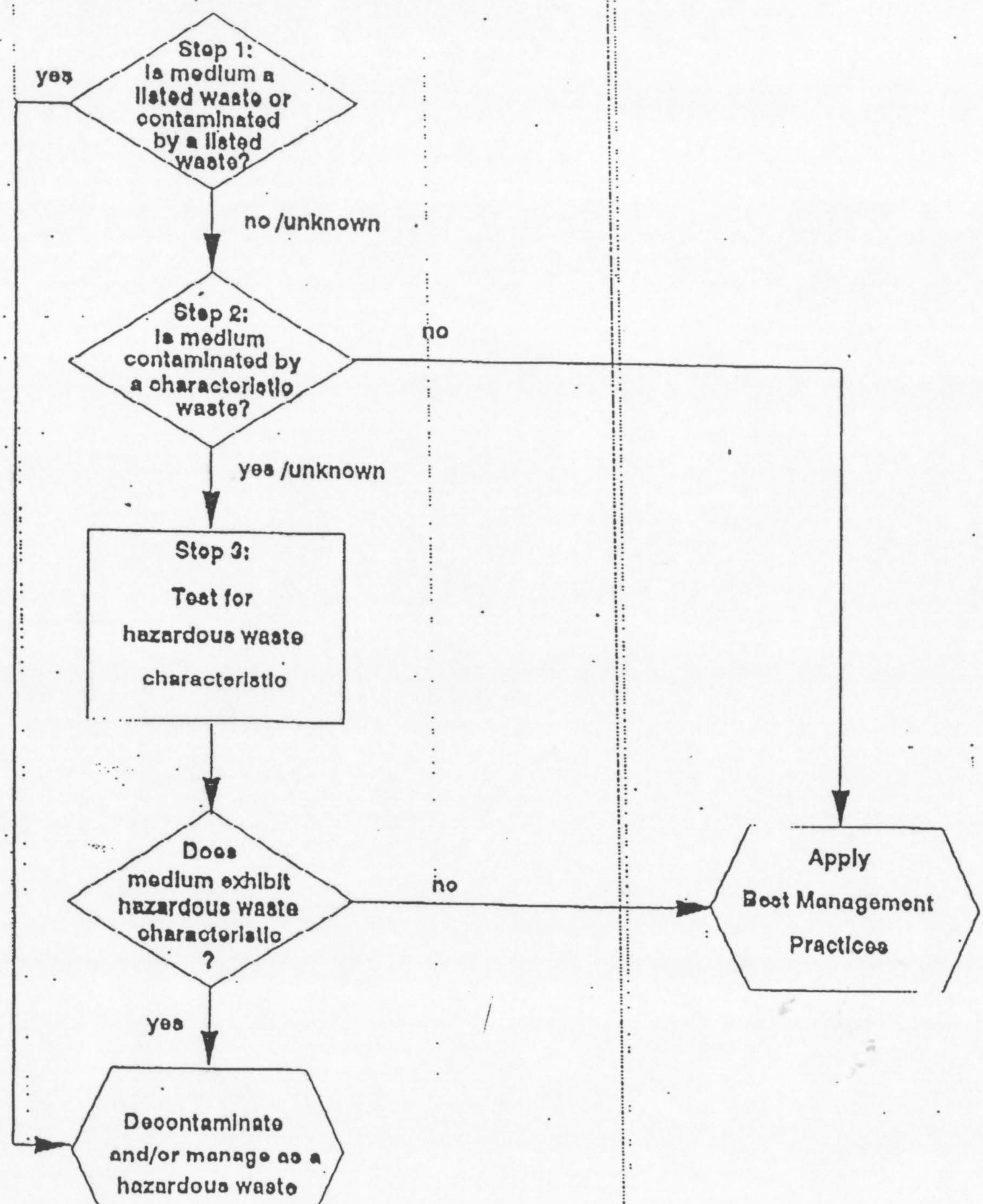
Contaminated environmental media may be generated or actively managed during CERCLA investigations, remedial actions and response actions. The National Contingency Plan (NCP) requires that for all remedial actions, the selected remedy must attain or exceed the applicable or relevant and appropriate requirements (ARARs) in environmental laws. It also requires removal actions to attain ARARs to the greatest extent practicable, considering the exigencies of the circumstances. This guidance is an interpretation of RCRA regulations and as such should be considered in evaluating ARARs for CERCLA activities.

When implementing this guidance into CERCLA activities, the user is encouraged to take full advantage of all waivers and exemptions provided under either RCRA or CERCLA. For example, CERCLA section 121(e) establishes that a RCRA permit is not required for any CERCLA removal and remedial actions conducted entirely on-site at NPL sites. OSWER Policy Directive #9522.00-2 extends this permit waiver authority to uncontrolled sites 8/ if the state has adopted equivalent language to CERCLA section 121(e).

In summary, this guidance represents an interpretation of RCRA regulations, directives and policy. Incorporation of this guidance into CERCLA activities should be evaluated similarly to any other RCRA ARAR.

8/ "Uncontrolled sites" are those hazardous waste sites which are being handled by the State's equivalent to the Superfund program.

DECISION MATRIX FOR MANAGING CONTAMINATED MEDIA



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch St
Philadelphia, Pennsylvania 19103

SUBJECT: Risk-Based Concentration Table **DATE:** 10/27/1999

FROM: Jennifer Hubbard, Toxicologist
Superfund Technical Support Section (3HS41)

TO: RBC Table Users

Attached is the EPA Region III Risk-Based Concentration (RBC) Table, which we prepare and post periodically for all interested parties.

> IMPORTANT NOTES: To make the RBC Table more accessible and to minimize paper usage, it is now primarily available through the Internet. The address is **http://www.epa.gov/reg3hwmd/risk/riskmenu.htm**. The Table is available in both Lotus and Excel as "self-extracting" files. These files should be downloaded and then processed with your computer's "run" function. The files can then be viewed in Lotus or Excel.
> If you have technical questions about the toxicological or risk assessment aspects of the RBCs, please contact Jennifer Hubbard at 215-814-3328 or hubbard.jennifer@epamail.epa.gov. Other questions can be addressed to Vanessa Sizer or Terri Fields at 215-814-3041. You can also consult the Frequently Asked Questions, below.

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The RBC Table contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for 400-500 chemicals. These toxicity factors have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use RBCs to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening"). The exposure equations come from EPA's Risk Assessment Guidance for Superfund (RAGS), while the exposure factors are those recommended in RAGS or supplemental guidance from the Superfund program. The attached technical background document provides specific equations and assumptions. Simply put, RBCs are like risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air, 2) cumulative risk from multiple contaminants or media, and (3) dermal risk. Additionally, the risks for inhalation of vapors from water are based on a very simple model, whereas detailed risk assessments may use more detailed showering models. Also, the toxicity information in the Table has been assembled by hand and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CSFs in the Table. If you note any errors, please let us know.

It is important to note that this Table uses inhalation RfDs and CSFs rather than RfCs (Reference Concentrations) and inhalation unit cancer risks. This is because the latter factors incorporate exposure assumptions and therefore can only be used for one exposure scenario. Because risk assessors need to evaluate risks for many types of scenarios, the factors have been converted to the more traditional RfDs and CSFs. Unless otherwise indicated in the toxicity-factor source, the assumption is that RfCs and unit risks should be adjusted by a 70-kilogram body weight and a 20 m^3/day inhalation rate to generate the RfDs and CSFs.

Many users want to know if the RBCs can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that <u>the RBC Table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment</u>. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all the health risk;

3. Volatilization, dermal contact, and other pathways not included in the RBCs are not expected to be significant;

4. The exposure scenarios and assumptions used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is not expected to be significant;

the RBCs would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the Table should generally not be used to set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, to substitute for EPA guidance for preparing baseline risk assessments, or to determine if a waste is hazardous under RCRA.

SPECIAL NOTES

The RBC Table was originally developed by Roy L. Smith, Ph.D., for use by risk assessors in the Region III Superfund program. Dr. Smith is no longer with Region III, and the Table continues to evolve. You may notice some modifications of formatting and conventions used in the Table.

For instance, besides formatting, the following changes are noteworthy:

- As usual, updated toxicity factors have been used wherever available. However, because IRIS and provisional values are updated more frequently than the RBC Table, RBC Table users are ultimately responsible for obtaining the most up-to-date values. The RBC Table is provided as a convenience, but toxicity factors are compiled from the original sources and it is those original sources that should serve as the definitive reference.

- Certain outdated and withdrawn numbers have been removed from the Table.

- Changes to the table have been marked with asterisks (**). Changes may involve a corrected CAS number or a correction in the VOC status, or they may reflect changes of RfDs and CSFs on IRIS.

- RBCs are no longer rounded to 1E6 ppm. For certain low-toxicity chemicals, the RBCs exceed possible concentrations at the target risks. In such cases, Dr. Smith rounded these numbers to the highest possible concentration, or 1E6 ppm. The rounding has been discontinued so that Table users can adjust the RBCs to a different target risk whenever necessary. For example, when screening chemicals at a target HQ of 0.1, noncarcinogenic RBCs may simply be divided by 10. Such scaling is not possible when RBCs are rounded.

- This Table was originally compiled to assist Superfund risk assessors in screening hazardous waste sites. The large number of chemicals made the Table unwieldy and difficult to keep current. Many of the chemicals did not typically (or even occasionally) appear at Superfund sites. Starting with the April 1998 version of the Table, the 600+ chemicals were reduced to some 400-500 chemicals by eliminating many of those atypical chemicals. Through time, the Table may continue to grow or decrease in size. Comments on this issue are appreciated. During the last eighteen months, only one request was received for restoration of a chemical: NuStar has been restored to the Table. (A list of the deleted chemicals is attached.)

- At Region III Superfund sites, noncancer RBCs are typically adjusted downward to correspond to a target HQ of 0.1 rather than 1. (This is done to ensure that chemicals with additive effects are not prematurely eliminated during screening.) However, some chemicals have RBCs at HQs of 0.1 that are lower than their RBCs at 1E-6 cancer risk. In other words, the screening RBC would change from carcinogenic to noncarcinogenic. A new feature of this Table is that these chemicals are now flagged with a "!" symbol. Therefore, assessors screening with adjusted RBCs will be alerted to this situation.

- Earlier versions of this Table included a substitution of inhalation toxicity factors for oral factors whenever oral factors were unavailable (this applied only to groundwater and air, but not soil or fish). This practice has been discontinued in order to minimize the uncertainty associated with such a conversion. The discontinuation of this practice does not significantly decrease the number of available RBCs.

- The criterion for "VOC status" is in accordance with RAGS Part B: chemicals with Henry's Law constants greater than 1E-5 <u>and</u> molecular weight less than 200 are now marked as VOCs. This increases consistency with the national guidance and with other EPA regions that use risk-based screening numbers.

- Earlier versions of this Table included soil screening levels (SSLs), when those values were available in draft form. Since the finalization of the SSL Guidance, risk assessors are urged to consult the final SSL Guidance directly. However, for generic use in Region III, the table now contains soil-to-groundwater SSLs in accordance with the new guidance. For more information, see the Region III memo on SSLs, or consult the national SSL guidance directly (<u>Soil Screening Guidance: User's Guide</u>, April 1996, Publication 9355.4-23; and <u>Soil Screening Guidance: Technical Background Document</u>, May 1996; EPA/540/R-95/128).

FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC Table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than the inhalation rate for either a child (12) or an adult (20)?

   Age-adjusted factors are not intake rates, but rather partial calculations which have different units from intake rates. (Therefore, they are not directly comparable.) The fact that these partial calculations have values similar to intake rates is really coincidental, an artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. For manganese, IRIS shows an oral RfD of 0.14 mg/kg/day, but the RBC Table uses 2E-2 mg/kg/day. Why?

The IRIS RfD includes manganese from all sources, including diet. The explanatory text in IRIS recommends using a modifying factor of 3 when calculating risks associated with non-food sources, and the Table follows this recommendation. IRIS also recommends subtracting dietary exposure (default assumption in this case 5 mg). Thus, the IRIS RfD has been lowered by a factor of 2 x 3, or 6. The Table now reflects manganese RBCs for both "food" and "non-food" (most environmental) sources.

3. What is the source of the child's inhalation rate of 12 m^3/day?

The calculation comes from basic physiology. It's a scaling of the mass-specific 20 m^3/day rate for adults from a body mass of 70 kg to 15 kg, using the 2/3 power of mass, as follows:

Ircm = mass-specific child inhalation rate (m^3/kg/day)
Irc = child inhalation rate (m^3/day)

20 m^3/day / 70 kg = 0.286 m^3/kg/day (mass-specific adult inhalation rate)

0.286 m^3/kg/day x ($70^{0.67}$) = (Ircm) x ($15^{0.67}$)

Ircm = 0.803 m^3/kg/day

Irc = Ircm x 15 kg = 0.803 m^3/kg/day x 15 kg = 12.04 m^3/day

4. Can the oral RfDs in the RBC Table be applied to dermal exposure?

Not directly. Oral RfDs are usually based on administered dose and therefore tacitly include a GI absorption factor. Thus, any use of oral RfDs in dermal risk calculations should involve removing this absorption factor. Consult the Risk Assessment Guidance for Superfund, Part A, Appendix A, for further details on how to do this.

5. The exposure variables table in the RBC background document lists the averaging time for non-carcinogens as "ED*365." What does that mean?

ED is exposure duration, in years, and * is the computer-ese symbol for multiplication. Multiplying ED by 365 simply converts the duration to days. In fact, the ED term is included in both the numerator and denominator of the RBC algorithms for non-cancer risk, canceling it altogether. See RAGS for more information.

6. Why is inorganic lead not included in the RBC Table?

EPA has no consensus RfD or CSF for inorganic lead, so it is not possible to calculate RBCs as we have done for other chemicals. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD.

EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. For water, we suggest 15 ug/l (the EPA Action Level in water), and for air, the National Ambient Air Quality Standard.

7. Where did the CSFs for carcinogenic PAHs come from?

The PAH CSFs are all calculated relative to benzo[a]pyrene, which has an IRIS slope factor. The relative factors for the other PAHs can be found in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," Final Draft, ECAO-CIN-842 (March, 1993).

8. May I please have a copy of a previous RBC Table?

We do not distribute outdated copies of the RBC Table. Each new version of the Table supersedes all previous versions.

9. Please elaborate on the meaning of the "W" source code in the Table.

The "W" code means that a RfD or CSF is currently not present on either IRIS or HEAST, but that it was once present on either IRIS or HEAST and was removed. Such withdrawal usually indicates that consensus on the number no longer exists among EPA scientists, but not that EPA believes the contaminant to be unimportant.

Withdrawn numbers are shown in the Table because we still need to deal with these contaminants during the long delays before replacement numbers are ready. For the purpose of screening, a "W" value is similar to a provisional value in that neither value has achieved Agency consensus. The "W" code should serve as a clear warning that before making any serious decision involving that contaminant, you will need to develop an interim value based on current scientific understanding.

If you are assessing risks at a site where a major contaminant is coded "W," consider working with your Region EPA risk assessor to develop a current toxicity constant. If the site is being studied under CERCLA, the EPA-NCEA Regional Technical Support group may be able to assist.

10. Can I get copies of supporting documents for interim toxicity constants which are coded "E" in the RBC Table?

Unfortunately, Region 3 does not have a complete set of supporting documents. The EPA-NCEA Superfund Technical Support Center prepares these interim toxicity constants in response to site-specific requests from Regional risk assessors, and sends the documentation only to the requestor. The RBC Tables contain only the latest interim values that we've either requested or have otherwise received. NCEA maintains the master data base of these chemicals, but will not release documentation of provisional values unless they are recent. Furthermore, since NCEA's Superfund Technical Support Center is mainly for the support of Superfund, it usually cannot develop new criteria unless authorized to do so for a specific Superfund project.

If an "E"-coded contaminant is a chemical of potential concern at your site, we urge you to work with the EPA Regional risk assessor assigned to the project in order to develop or obtain documentation for provisional values. EPA Region 3 furnishes documents only when needed to support Regional risk assessments or recommendations.

11. Why is there no oral RfD for mercury? How should I handle mercury?

IRIS gives oral RfDs for mercuric chloride and for methylmercury, but not for elemental mercury. Therefore, the RBC Table reflects this primary source. Consult your toxicologist to determine which of the available mercury numbers is suitable for the conditions at your site (e.g., whether mercury is likely to be organic or inorganic.)

Attachment

"DISCONTINUED" CHEMICALS

These chemicals may still have toxicity criteria available in IRIS, HEAST, or NCEA provisional values. However, they are not routine chemicals and therefore will not be routinely maintained in the RBC Table, unless our Table users report a significant need for chemicals to be re-added. Some of the chemicals on this Table were deleted because supporting toxicity information has been withdrawn or is unavailable.

acephate
acetone cyanohyrin
acifluorfen
acrylic acid
ally
allyl alcohol
aluminum phosphide
amdro
ametryn
m-aminophenol
amitraz
ammonium sulfamate
antimony potassium tartrate
apollo
aramite
asulam
avermectin B1
barium cyanide
bayleton
benefin
benomyl
benzotrichloride
bidrin
biphenthin
bis(2-chloro-1-methylethyl)ether
bisphenol A
boron trifluoride
4-bromophenyl phenyl ether
bromoxynil
bromoxynil octanoate
butylphthalyl butylglycolate
cacodylic acid
captafol
captan
carboxin
chloramben
chlorimuron-ethyl
chloroacetaldehyde
2-chloroacetophenone
4-chlorobenzotrifluoride
2-chloroethyl vinyl ether
4-chloro-2-methylaniline hydrochloride
chlorothalonil
chlorpropham
chlorsulfuron
chlorthiophos
coal tar creosote
cyclohexlamine
cyromazine
danitol
decabromodiphenyl ether
demeton
diallate
diethylforamide
diflubenzuron
dimethipin
dimethoate
N,N-dimethylformamide
dimethyl terephthalate
diphenamid
direct black 38
direct blue 6
direct brown 95

dodine	1,2-epoxybutane
ethephon	2-ethoxyethanol acetate
ethyl acrylate	EPTC
ethylene cyanohydrin	
ethyl p-nitrophenyl phenylphosphorothioate	
ethylphthalyl ethyl glycolate	express
fluoridone	flurprimidol
flutolanil	fluvalinate
folpet	fosteyl-al
furium	furmecyclox
glufosinate-ammonium	haloxyfop-methyl
harmony	imazalil
imazaquin	iprodione
isoxaben	kepone
lactofen	linuron
londax	
maleic hydrazide	malononitrile
mancozeb	maneb
merphos	merphos oxide
metalaxyl	methamidophos
methomyl	2-methoxyethanol acetate
2-methoxyethanol	2-methoxy-5-nitroaniline
2-methylaniline hydrochloride	methyl chlorocarbonate
4,4-methylene bisbenzeneamine	metribuzin
molinate	2-naphthylamine
napropamide	
nickel subsulfide	nitrapyrin
3-nitroaniline	4-nitroaniline
nitroguanidine	norflurazon
octabromodiphenyl ether	
octamethylpyrophosphoramide	paclobutrazol
pebulate	pendimethalin
pentabromo-6-chlorocyclohexane	
pentabromodiphenyl ether	phenmedipham
phenylmercuric acetate	phorate
phosmet	picloram
pirimiphos-methyl	prochloraz
profluralin	pronamide
propargyl alcohol	propazine
propham	propiconazole
propylene oxide	pydrin

quinalphos	savey
selenourea	sethoxydim
sodium fluoroacetate	sodium metavanadate
systhane	tebuthiuron
temephos	terbacil
terbufos	terbutryn
tetrachlorovinphos	tetraethyldithiopyrophosphate
thallium selenide	
2-(thiocyanomethylthio)-benzothiazole	
thiofanox	thiophanate-methyl
thiram	tralomethrin
triallate	triasulfuron
2,4,6-trichloroaniline hydrochloride	
tridiphane	triethylamine
trifluralin	vernam

EPA Region III RBC Table 10/7/1999 1

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 <

							Risk-based concentrations					
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	
ACETALDEHYDE	75070			2.57E-03 I	7.7E-03 I	y	1.6E+00 C	8.1E-01 C				
ACETOCHLOR	34256821	2E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N	
ACETONE	67641	1.00E-01 I				y	6.1E+02 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N	
ACETONITRILE	75058			1.7E-02 I		y	1.2E+02 N	6.2E+01 N				
ACETOPHENONE	98862	1.00E-01 I		5.70E-06 W		y	4.2E-02 N	2.1E-02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N	
ACROLEIN	107028	2.00E-02 H		5.70E-06 I		y	4.2E-02 N	2.1E-02 N	2.7E+01 N	4.1E+04 N	1.6E+03 N	
ACRYLAMIDE	79061	2.00E-04 I	4.50E+00 I		4.50E+00 I		1.5E-02 C	1.4E-03 C	7.0E-04 C	1.3E+00 C	1.4E-01 C	
ACRYLONITRILE	107131	1.00E-03 H	5.40E-01 I	5.70E-04 I	2.40E-01 I	y	3.7E-02 C	2.6E-02 C	5.8E-03 C	1.1E+01 C	1.2E+00 C	
ALACHLOR	15972608	1.00E-02 I	8.00E-02 H				8.4E-01 C	7.8E-02 C	3.9E-02 C	7.2E+01 C	8.0E+00 C	
ALAR	1596845	1.50E-01 I					5.5E+03 N	5.5E+02 N	2.0E+02 N	3.1E+05 N	1.2E+04 N	
ALDICARB	116063	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N	
ALDICARB SULFONE	1646884	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N	
ALDRIN	309002	3.00E-05 I	1.70E+01 I		1.70E+01 I		3.9E-03 C	3.7E-04 C	1.9E-04 C	3.4E-01 C	3.8E-02 C	
ALUMINUM	7429905	1.00E+00 E		1.00E-03 E			3.7E+04 N	3.7E+00 N	1.4E+03 N	2.0E+06 N	7.8E+04 N	
AMINODINITROTOLUENES		6.00E-05 E					2.2E+00 N	2.2E-01 N	8.1E-02 N	1.2E+02 N	4.7E+00 N	
4-AMINOPYRIDINE	504245	2.00E-05 H					7.3E-01 N	7.3E-02 N	2.7E-02 N	4.1E+01 N	1.6E+00 N	
AMMONIA	7664417			2.86E-02 I		y	2.1E+02 N	1.0E+02 N				
ANILINE	62533	7.00E-03 E	5.70E-03 I	2.90E-04 I			1.2E+01 C	1.1E+00 N	5.5E-01 C	1.0E+03 C	1.1E+02 C	!
ANTIMONY	7440360	4.00E-04 I					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N	
ANTIMONY PENTOXIDE	1314609	5.00E-04 H					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N	
ANTIMONY TETROXIDE	1332816	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N	
ANTIMONY TRIOXIDE	1309644	4.00E-04 H		5.70E-05 I			1.5E+01 N	2.1E-01 N	5.4E-01 N	8.2E+02 N	3.1E+01 N	
ARSENIC	7440382	3.00E-04 I	1.50E+00 I		1.51E+01 I		4.5E-02 C	4.1E-04 C	2.1E-03 C	3.8E+00 C	4.3E-01 C	
ARSINE	7784421			1.40E-05 I		y	1.0E-01 N	5.1E-02 N				
ASSURE	76578148	9.00E-03 I					3.3E+02 N	3.3E+01 N	1.2E+01 N	1.8E+04 N	7.0E+02 N	
ATRAZINE	1912249	3.50E-02 I	2.20E-01 H				3.0E-01 C	2.8E-02 C	1.4E-02 C	2.6E+01 C	2.9E+00 C	
AZOBENZENE	103333		1.10E-01 I		1.10E-01 I		6.1E-01 C	5.7E-02 C	2.9E-02 C	5.2E+01 C	5.8E+00 C	
BARIUM	7440393	7.00E-02 I		1.40E-04 A			2.6E+03 N	5.1E-01 N	9.5E+01 N	1.4E+05 N	5.5E+03 N	
BAYGON	114261	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N	
BAYTHROID	68359375	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N	
BENTAZON	25057890	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N	
BENZALDEHYDE	100527	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N	
BENZENE	71432	3.00E-03 E	2.90E-02 I	1.70E-03 E	2.90E-02 I	y	3.6E-01 C	2.2E-01 C	1.1E-01 C	2.0E+02 C	2.2E+01 C	
BENZENETHIOL	108985	1.00E-05 H				y	6.1E-02 N	3.7E-02 N	1.4E-02 N	2.0E+01 N	7.8E-01 N	
BENZIDINE	92875	3.00E-03 I	2.30E+02 I		2.30E+02 I		2.9E-04 C	2.7E-05 C	1.4E-05 C	2.5E-02 C	2.8E-03 C	
BENZOIC ACID	65850	4.00E+00 I					1.5E+05 N	1.5E+04 N	5.4E+03 N	8.2E+06 N	3.1E+05 N	
BENZYL ALCOHOL	100516	3.00E-01 H					1.1E+04 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N	
BENZYL CHLORIDE	100447		0.17 I			y	6.2E-02 C	3.7E-02 C	1.9E-02 C	3.4E+01 C	3.8E+00 C	
BERYLLIUM	7440417	2.00E-03 I		5.7E-06 I	8.40E+00 I		7.3E+01 N	7.5E-04 C	2.7E+00 N	4.1E+03 N	1.6E+02 N	
BIPHENYL	92524	5.00E-02 I				y	3.0E+02 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N	
BIS(2-CHLOROETHYL)ETHER	111444		1.10E+00 I		1.10E+00 I	y	9.6E-03 C	5.7E-03 C	2.9E-03 C	5.2E+00 C	5.8E-01 C	
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-02 I	7.00E-02 H		3.50E-02 H	y	2.6E-01 C	1.8E-01 C	4.5E-02 C	8.2E+01 C	9.1E+00 C	
BIS(CHLOROMETHYL)ETHER	542881		2.20E+02 I		2.20E+02 I	y	4.8E-05 C	2.8E-05 C	1.4E-05 C	2.6E-02 C	2.9E-03 C	
BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-02 I	1.40E-02 I		1.40E-02 E		4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C	
BORON	7440428	9.00E-02 I		5.70E-03 H			3.3E+03 N	2.1E+01 N	1.2E+02 N	1.8E+05 N	7.0E+03 N	

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < Risk-based concentrations

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
BROMODICHLOROMETHANE	75274	2.00E-02 I	6.20E-02 I			y	1.7E-01 C	1.0E-01 C	5.1E-02 C	9.2E+01 C	1.0E+01 C
BROMOETHENE	593602			8.6E-04 I	1.10E-01 H	y	1.1E-01 C	5.7E-02 C			
BROMOFORM	75252	2.00E-02 I	7.90E-03 I		3.90E-03 I		8.5E+00 C	1.6E+00 C	4.0E-01 C	7.2E+02 C	8.1E+01 C
BROMOMETHANE	74839	1.40E-03 I		1.40E-03 I		y	8.5E+00 N	5.1E+00 N	1.9E+00 N	2.9E+03 N	1.1E+02 N
BROMOPHOS	2104963	5.00E-03 H					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
1,3-BUTADIENE	106990				1.80E+00 H	y	7.0E-03 C	3.5E-03 C			
1-BUTANOL	71363	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
BUTYLBENZYLPHTHALATE	85687	2.00E-01 I					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
BUTYLATE	2008415	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
N-BUTYLBENZENE	104518	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
SEC-BUTYLBENZENE	135988	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
TERT-BUTYLBENZENE	98066	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
**CADMIUM-WATER	7440439	5.00E-04 I		5.7E-05 E	6.30E+00 I		1.8E+01 N	9.9E-04 C	6.8E-01 N	1.0E+03 N	3.9E+01 N
**CADMIUM-FOOD	7440439	1.00E-03 I		5.7E-05 E	6.30E+00 I		3.7E+01 N	9.9E-04 C	1.4E+00 N	2.0E+03 N	7.8E+01 N
CAPROLACTAM	105602	5.00E-01 I					1.8E+04 N	1.8E+03 N	6.8E+02 N	1.0E+06 N	3.9E+04 N
CARBARYL	63252	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CARBON DISULFIDE	75150	1.00E-01 I		2.00E-01 I		y	1.0E+03 N	7.3E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CARBON TETRACHLORIDE	56235	7.00E-04 I	1.30E-01 I	5.71E-04 E	5.30E-02 I	y	1.6E-01 C	1.2E-01 C	2.4E-02 C	4.4E+01 C	4.9E+00 C
CARBOSULFAN	55285148	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
CHLORAL	75876	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
CHLORANIL	118752		4.00E-01 H				1.7E-01 C	1.6E-02 C	7.9E-03 C	1.4E+01 C	1.6E+00 C
CHLORDANE	57749	5.00E-04 I	3.5E-01 I	2.00E-04 I	3.5E-01 I		1.9E-01 C	1.8E-02 C	9.0E-03 C	1.6E+01 C	1.8E+00 C
**CHLORINE	7782505	1.00E-01 I		5.7E-05 E		y	4.2E-01 N	2.1E-01 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CHLORINE DIOXIDE	10049044			5.70E-05 I		y	4.2E-01 N	2.1E-01 N			
CHLOROACETIC ACID	79118	2.00E-03 H					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
4-CHLOROANILINE	106478	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
CHLOROBENZENE	108907	2.00E-02 I		1.7E-02 E		y	1.1E+02 N	6.2E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CHLOROBENZILATE	510156	2.00E-02 I	2.70E-01 H		2.70E-01 H		2.5E-01 C	2.3E-02 C	1.2E-02 C	2.1E+01 C	2.4E+00 C
P-CHLOROBENZOIC ACID	74113	2.00E-01 H					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
2-CHLORO-1,3-BUTADIENE	126998	2.00E-02 A		2.00E-03 H		y	1.4E+01 N	7.3E+00 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
1-CHLOROBUTANE	109693	4.00E-01 H				y	2.4E+03 N	1.5E+03 N	5.4E+02 N	8.2E+05 N	3.1E+04 N
1-CHLORO-1,1-DIFLUOROETHANE	75683			1.40E+01 I		y	1.0E+05 N	5.1E+04 N			
CHLORODIFLUOROMETHANE	75456			1.40E+01 I		y	1.0E+05 N	5.1E+04 N			
CHLOROETHANE	75003	4.00E-01 E	2.90E-03 E	2.90E+00 I		y	3.6E+00 C	2.2E+00 C	1.1E+00 C	2.0E+03 C	2.2E+02 C
CHLOROFORM	67663	1.00E-02 I	6.10E-03 I	8.6E-05 E	8.10E-02 I	y	1.5E-01 C !	7.7E-02 C !	5.2E-01 C	9.4E+02 C	1.0E+02 C !
CHLOROMETHANE	74873		1.30E-02 H	8.6E-02 E	3.5E-03 E	y	2.1E+00 C	1.8E+00 C	2.4E-01 C	4.4E+02 C	4.9E+01 C
4-CHLORO-2-METHYLANILINE	95692		5.80E-01 H				1.2E-01 C	1.1E-02 C	5.4E-03 C	9.9E+00 C	1.1E+00 C
BETA-CHLORONAPHTHALENE	91587	8.00E-02 I				y	4.9E+02 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
O-CHLORONITROBENZENE	88733		2.50E-02 H			y	4.2E-01 C	2.5E-01 C	1.3E-01 C	2.3E+02 C	2.6E+01 C
P-CHLORONITROBENZENE	100005		1.80E-02 H			y	5.9E-01 C	3.5E-01 C	1.8E-01 C	3.2E+02 C	3.5E+01 C
2-CHLOROPHENOL	95578	5.00E-03 I				y	3.0E+01 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
2-CHLOROPROPANE	75296			2.90E-02 H		y	2.1E+02 N	1.1E+02 N			
O-CHLOROTOLUENE	95498	2.00E-02 I				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CHLORPYRIFOS	2921882	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
CHLORPYRIFOS-METHYL	5598130	1.00E-02 H					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA-NCEA provisional value O = other							Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
CHROMIUM III	16065831	1.50E+00 I					5.5E+04 N	5.5E+03 N	2.0E+03 N	3.1E+06 N	1.2E+05 N
CHROMIUM VI	18540299	3.00E-03 I		3.00E-05 I	4.10E+01 H		1.1E+02 N	1.5E-04 C	4.1E+00 N	6.1E+03 N	2.3E+02 N
COBALT	7440484	6.00E-02 E					2.2E+03 N	2.2E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
COKE OVEN EMISSIONS (COAL TAR)	8007452				2.2 I			2.8E-03 C			
COPPER	7440508	4.00E-02 H					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
CROTONALDEHYDE	123739		1.90E+00 H			y	5.6E-03 C	3.3E-03 C	1.7E-03 C	3.0E+00 C	3.4E-01 C
CUMENE	98828	1.00E-01 I		1.10E-01 I		y	6.6E+02 N	4.0E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CYANIDE (FREE)	57125	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CALCIUM CYANIDE	592018	4E-02 I					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
COPPER CYANIDE	544923	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
CYANAZINE	21725462	2.00E-03 H	8.40E-01 H				8.0E-02 C	7.5E-03 C	3.8E-03 C	6.8E+00 C	7.6E-01 C
CYANOGEN	460195	4.00E-02 I				y	2.4E+02 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
CYANOGEN BROMIDE	506683	9.00E-02 I					3.3E+03 N	3.3E+02 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
CYANOGEN CHLORIDE	506774	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
HYDROGEN CYANIDE	74908	2.00E-02 I		8.60E-04 I		y	6.2E+00 N	3.1E+00 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
POTASSIUM CYANIDE	151508	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
POTASSIUM SILVER CYANIDE	506616	2.00E-01 I					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
SILVER CYANIDE	506649	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
SODIUM CYANIDE	143339	4.00E-02 I					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
**THIOCYANATE		5.00E-02 E					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
ZINC CYANIDE	557211	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
CYCLOHEXANONE	108941	5.00E+00 I					1.8E+05 N	1.8E+04 N	6.8E+03 N	1.0E+07 N	3.9E+05 N
CYHALOTHRIN/KARATE	68085858	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
CYPERMETHRIN	52315078	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DACTHAL	1861321	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DALAPON	75990	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
DDD	72548		2.40E-01 I				2.8E-01 C	2.6E-02 C	1.3E-02 C	2.4E+01 C	2.7E+00 C
DDE	72559		3.40E-01 I				2.0E-01 C	1.8E-02 C	9.3E-03 C	1.7E+01 C	1.9E+00 C
DDT	50293	5.00E-04 I	3.40E-01 I		3.40E-01 I		2.0E-01 C	1.8E-02 C	9.3E-03 C	1.7E+01 C	1.9E+00 C
DIAZINON	333415	9.00E-04 H					3.3E+01 N	3.3E+00 N	1.2E+00 N	1.8E+03 N	7.0E+01 N
DIBENZOFURAN	132649	4.00E-03 E				y	2.4E+01 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
1,4-DIBROMOBENZENE	106376	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DIBROMOCHLOROMETHANE	124481	2.00E-02 I	8.40E-02 I			y	1.3E-01 C	7.5E-02 C	3.8E-02 C	6.8E+01 C	7.6E+00 C
1,2-DIBROMO-3-CHLOROPROPANE	96128		1.40E+00 H	5.70E-05 I	2.40E-03 H	y	4.7E-02 C !	2.1E-01 N	2.3E-03 C	4.1E+00 C	4.6E-01 C
1,2-DIBROMOETHANE	106934		8.50E+01 I	5.70E-05 H	7.60E-01 I	y	7.5E-04 C	8.2E-03 C	3.7E-05 C	6.7E-02 C	7.5E-03 C
DIBUTYLPHTHALATE	84742	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
DICAMBA	1918009	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
**1,2-DICHLOROBENZENE	95501	9.00E-02 I				y	5.5E+02 N	3.3E+02 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
1,3-DICHLOROBENZENE	541731	9.00E-04 E				y	5.5E+00 N	3.3E+00 N	1.2E+00 N	1.8E+03 N	7.0E+01 N
1,4-DICHLOROBENZENE	106467	3.00E-02 E	2.40E-02 H	2.29E-01 I	2.2E-02 E	y	4.7E-01 C	2.8E-01 C	1.3E-01 C	2.4E+02 C	2.7E+01 C
3,3'-DICHLOROBENZIDINE	91941		4.50E-01 I				1.5E-01 C	1.4E-02 C	7.0E-03 C	1.3E+01 C	1.4E+00 C
1,4-DICHLORO-2-BUTENE	764410				9.30E+00 H	y	1.3E-03 C	6.7E-04 C			
DICHLORODIFLUOROMETHANE	75718	2.00E-01 I		5.00E-02 A		y	3.5E+02 N	1.8E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
1,1-DICHLOROETHANE	75343	1.00E-01 H		1.40E-01 A		y	8.0E+02 N	5.1E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
1,2-DICHLOROETHANE	107062	3.00E-02 E	9.10E-02 I	1.40E-03 E	9.10E-02 I	y	1.2E-01 C	6.9E-02 C	3.5E-02 C	6.3E+01 C	7.0E+00 C

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < Risk-based concentrations

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	
1,1-DICHLOROETHENE	75354	9.00E-03 I	6.00E-01 I		1.75E-01 I	y	4.4E-02 C	3.6E-02 C	5.3E-03 C	9.5E+00 C	1.1E+00 C	
CIS-1,2-DICHLOROETHENE	156592	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N	
TRANS-1,2-DICHLOROETHENE	156605	2.00E-02 I				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N	
TOTAL 1,2-DICHLOROETHENE	540590	9.00E-03 H				y	5.5E+01 N	3.3E+01 N	1.2E+01 N	1.8E+04 N	7.0E+02 N	
2,4-DICHLOROPHENOL	120832	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N	
2,4-D	94757	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N	
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826	8E-03 I					2.9E+02 N	2.9E+01 N	1.1E+01 N	1.6E+04 N	6.3E+02 N	
1,2-DICHLOROPROPANE	78875		6.80E-02 H	1.14E-03 I		y	1.6E-01 C	9.2E-02 C	4.6E-02 C	8.4E+01 C	9.4E+00 C	
2,3-DICHLOROPROPANOL	616239	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N	
1,3-DICHLOROPROPENE	542756	3.00E-04 I	1.80E-01 H	5.71E-03 I	1.30E-01 H	y	7.7E-02 C	4.8E-02 C	1.8E-02 C	3.2E+01 C	3.5E+00 C	!
DICHLORVOS	62737	5E-04 I	0.29 I	1.43E-04 I			2.3E-01 C	2.2E-02 C	1.1E-02 C	2.0E+01 C	2.2E+00 C	
DICOFOL	115322		4.4E-01 W				1.5E-01 C	1.4E-02 C	7.2E-03 C	1.3E+01 C	1.5E+00 C	
DICYCLOPENTADIENE	77736	3E-02 H		6.00E-05 A		y	4.4E-01 N	2.2E-01 N	4.1E+01 N	6.1E+04 N	2.3E+03 N	
DIELDRIN	60571	5.00E-05 I	1.60E+01 I		1.60E+01 I		4.2E-03 C	3.9E-04 C	2.0E-04 C	3.6E-01 C	4.0E-02 C	
DIESEL EMISSIONS				1.40E-03 I				5.1E+00 N				
DIETHYLPHTHALATE	84662	8.00E-01 I					2.9E+04 N	2.9E+03 N	1.1E+03 N	1.6E+06 N	6.3E+04 N	
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			5.70E-03 H				2.1E+01 N				
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900	2.00E+00 H					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N	
DI(2-ETHYLHEXYL)ADIPATE	103231	6.00E-01 I	1.20E-03 I				5.6E+01 C	5.2E+00 C	2.6E+00 C	4.8E+03 C	5.3E+02 C	
DIETHYLSTILBESTROL	56531		4.70E+03 H				1.4E-05 C	1.3E-06 C	6.7E-07 C	1.2E-03 C	1.4E-04 C	
DIFENZOQUAT (AVENGE)	43222486	8.00E-02 I					2.9E+03 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N	
1,1-DIFLUOROETHANE	75376			1.10E+01 I		y	8.0E+04 N	4.0E+04 N				
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756	8.00E-02 I					2.9E+03 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N	
3,3'-DIMETHOXYBENZIDINE	119904		1.40E-02 H				4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C	
DIMETHYLAMINE	124403			5.70E-06 W		y	4.2E-02 N	2.1E-02 N				
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964		5.80E-01 H				1.2E-01 C	1.1E-02 C	5.4E-03 C	9.9E+00 C	1.1E+00 C	
2,4-DIMETHYLANILINE	95681		7.50E-01 H				8.9E-02 C	8.3E-03 C	4.2E-03 C	7.6E+00 C	8.5E-01 C	
N,N-DIMETHYLANILINE	121697	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N	
3,3'-DIMETHYLBENZIDINE	119937		9.20E+00 H				7.3E-03 C	6.8E-04 C	3.4E-04 C	6.2E-01 C	6.9E-02 C	
1,1-DIMETHYLHYDRAZINE	57147		2.60E+00 W		3.50E+00 W		2.6E-02 C	1.8E-03 C	1.2E-03 C	2.2E+00 C	2.5E-01 C	
1,2-DIMETHYLHYDRAZINE	540738		3.70E+01 W		3.70E+01 W		1.8E-03 C	1.7E-04 C	8.5E-05 C	1.5E-01 C	1.7E-02 C	
2,4-DIMETHYLPHENOL	105679	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N	
2,6-DIMETHYLPHENOL	576261	6.00E-04 I					2.2E+01 N	2.2E+00 N	8.1E-01 N	1.2E+03 N	4.7E+01 N	
3,4-DIMETHYLPHENOL	95658	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N	
DIMETHYLPHTHALATE	131113	1.00E+01 W					3.7E+05 N	3.7E+04 N	1.4E+04 N	2.0E+07 N	7.8E+05 N	
1,2-DINITROBENZENE	528290	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N	
1,3-DINITROBENZENE	99650	1.00E-04 I					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N	
1,4-DINITROBENZENE	100254	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N	
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N	
4,6-DINITRO-2-METHYLPHENOL	534521	1.00E-04 E					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N	
2,4-DINITROPHENOL	51285	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N	
DINITROTOLUENE MIX			6.80E-01 I				9.8E-02 C	9.2E-03 C	4.6E-03 C	8.4E+00 C	9.4E-01 C	
2,4-DINITROTOLUENE	121142	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N	
2,6-DINITROTOLUENE	606202	1.00E-03 H					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N	
DINOSEB	88857	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N	

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 <
Risk-based concentrations

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
DIOCTYLPHTHALATE	117840	2.00E-02 H					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
1,4-DIOXANE	123911		1.10E-02 I				6.1E+00 C	5.7E-01 C	2.9E-01 C	5.2E+02 C	5.8E+01 C
DIPHENYLAMINE	122394	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
1,2-DIPHENYLHYDRAZINE	122667		8.00E-01 I		8.00E-01 I		8.4E-02 C	7.8E-03 C	3.9E-03 C	7.2E+00 C	8.0E-01 C
DIQUAT	85007	2.20E-03 I					8.0E+01 N	8.0E+00 N	3.0E+00 N	4.5E+03 N	1.7E+02 N
DISULFOTON	298044	4.00E-05 I					1.5E+00 N	1.5E-01 N	5.4E-02 N	8.2E+01 N	3.1E+00 N
1,4-DITHIANE	505293	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DIURON	330541	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
ENDOSULFAN	115297	6.00E-03 I					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
ENDRIN	72208	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
EPICHLOROHYDRIN	106898	2.00E-03 H	9.90E-03 I	2.86E-04 I	4.20E-03 I	y	2.0E+00 N	1.0E+00 N	3.2E-01 C	5.8E+02 C !	6.5E+01 C !
ETHION	563122	5.00E-04 I					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
2-ETHOXYETHANOL	110805	4.00E-01 H		5.70E-02 I			1.5E+04 N	2.1E+02 N	5.4E+02 N	8.2E+05 N	3.1E+04 N
ETHYL ACETATE	141786	9.00E-01 I				y	5.5E+03 N	3.3E+03 N	1.2E+03 N	1.8E+06 N	7.0E+04 N
ETHYLBENZENE	100414	1.00E-01 I		2.90E-01 I		y	1.3E+03 N	1.1E+03 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
ETHYLENE DIAMINE	107153	2.00E-02 H					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
ETHYLENE GLYCOL	107211	2.00E+00 I					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762			5.70E-03 H				2.1E+01 N			
ETHYLENE OXIDE	75218		1.00E+00 H		3.50E-01 H	y	2.3E-02 C	1.8E-02 C	3.2E-03 C	5.7E+00 C	6.4E-01 C
ETHYLENE THIOUREA	96457	8.00E-05 I	1.1E-01 H				6.1E-01 C !	5.7E-02 C !	2.9E-02 C !	5.2E+01 C !	5.8E+00 C !
ETHYL ETHER	60297	2.00E-01 I				y	1.2E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
ETHYL METHACRYLATE	97632	9.00E-02 H				y	5.5E+02 N	3.3E+02 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
FENAMIPHOS	22224926	2.50E-04 I					9.1E+00 N	9.1E-01 N	3.4E-01 N	5.1E+02 N	2.0E+01 N
FLUOMETURON	2164172	1.30E-02 I					4.7E+02 N	4.7E+01 N	1.8E+01 N	2.7E+04 N	1.0E+03 N
FLUORINE	7782414	6.00E-02 I					2.2E+03 N	2.2E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
FOMESAFEN	72178020		1.90E-01 I				3.5E-01 C	3.3E-02 C	1.7E-02 C	3.0E+01 C	3.4E+00 C
FONOFOS	944229	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
FORMALDEHYDE	50000	2.00E-01 I			4.50E-02 I		7.3E+03 N	1.4E-01 C	2.7E+02 N	4.1E+05 N	1.6E+04 N
FORMIC ACID	64186	2.00E+00 H					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
FURAN	110009	1.00E-03 I				y	6.1E+00 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
FURAZOLIDONE	67458		3.80E+00 H				1.8E-02 C	1.6E-03 C	8.3E-04 C	1.5E+00 C	1.7E-01 C
FURFURAL	98011	3.00E-03 I		1.00E-02 A			1.1E+02 N	3.7E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
GLYCIDALDEHYDE	765344	4.00E-04 I		2.90E-04 H			1.5E+01 N	1.1E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
GLYPHOSATE	1071836	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
HEPTACHLOR	76448	5.00E-04 I	4.50E+00 I		4.50E+00 I		1.5E-02 C	1.4E-03 C	7.0E-04 C	1.3E+00 C	1.4E-01 C
HEPTACHLOR EPOXIDE	1024573	1.30E-05 I	9.10E+00 I		9.10E+00 I		7.4E-03 C	6.9E-04 C	3.5E-04 C	6.3E-01 C	7.0E-02 C
HEXABROMOBENZENE	87821	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
HEXACHLOROBENZENE	118741	8.00E-04 I	1.60E+00 I		1.60E+00 I		4.2E-02 C	3.9E-03 C	2.0E-03 C	3.6E+00 C	4.0E-01 C
HEXACHLOROBUTADIENE	87683	2.00E-04 H	7.80E-02 I		7.80E-02 I		8.6E-01 C !	8.0E-02 C !	4.0E-02 C !	7.3E+01 C !	8.2E+00 C !
ALPHA-HCH	319846		6.30E+00 I		6.30E+00 I		1.1E-02 C	9.9E-04 C	5.0E-04 C	9.1E-01 C	1.0E-01 C
BETA-HCH	319857		1.80E+00 I		1.80E+00 I		3.7E-02 C	3.5E-03 C	1.8E-03 C	3.2E+00 C	3.5E-01 C
GAMMA-HCH (LINDANE)	58899	3.00E-04 I	1.30E+00 H				5.2E-02 C	4.8E-03 C	2.4E-03 C	4.4E+00 C	4.9E-01 C
TECHNICAL HCH	608731		1.80E+00 I		1.80E+00 I		3.7E-02 C	3.5E-03 C	1.8E-03 C	3.2E+00 C	3.5E-01 C
HEXACHLOROCYCLOPENTADIENE	77474	7.00E-03 I		2.00E-05 H			2.6E+02 N	7.3E-02 N	9.5E+00 N	1.4E+04 N	5.5E+02 N
HEXACHLORODIBENZODIOXIN MIX	19408743		6.20E+03 I		4.55E+03 I		1.1E-05 C	1.4E-06 C	5.1E-07 C	9.2E-04 C	1.0E-04 C

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Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
HEXACHLOROETHANE	67721	1.00E-03 I	1.40E-02 I		1.40E-02 I		4.8E+00 C !	4.5E-01 C !	2.3E-01 C !	4.1E+02 C !	4.6E+01 C !
HEXACHLOROPHENE	70304	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			2.90E-06 I				1.1E-02 N			
HEXANE	110543	6.00E-02 H		5.71E-02 I		y	3.5E+02 N	2.1E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
2-HEXANONE	591786	4.00E-02 E		1.4E-03 E			1.5E+03 N	5.1E+00 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
HEXAZINONE	51235042	3.30E-02 I					1.2E+03 N	1.2E+02 N	4.5E+01 N	6.7E+04 N	2.6E+03 N
HMX	2691410	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
HYDRAZINE	302012		3.00E+00 I		1.70E+01 I		2.2E-02 C	3.7E-04 C	1.1E-03 C	1.9E+00 C	2.1E-01 C
HYDROGEN CHLORIDE	7647010			5.70E-03 I				2.1E+01 N			
HYDROGEN SULFIDE	7783064	3.00E-03 I		2.85E-04 I			1.1E+02 N	1.0E+00 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
HYDROQUINONE	123319	4.00E-02 H					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
IRON	7439896	3.00E-01 E					1.1E+04 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
ISOBUTANOL	78831	3.00E-01 I				y	1.8E+03 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
ISOPHORONE	78591	2.00E-01 I	9.50E-04 I				7.0E+01 C	6.6E+00 C	3.3E+00 C	6.0E+03 C	6.7E+02 C
ISOPROPALIN	33820530	1.50E-02 I					5.5E+02 N	5.5E+01 N	2.0E+01 N	3.1E+04 N	1.2E+03 N
ISOPROPYL METHYL PHOSPHONIC ACID	1832548	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
TETRAETHYLLEAD	78002	1.00E-07 I					3.7E-03 N	3.7E-04 N	1.4E-04 N	2.0E-01 N	7.8E-03 N
LITHIUM	7439932	2.00E-02 E					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MALATHION	121755	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MALEIC ANHYDRIDE	108316	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
MANGANESE-NONFOOD	7439965	2.00E-02 I		1.43E-05 I			7.3E+02 N	5.2E-02 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MANGANESE-FOOD	7439965	1.40E-01 I		1.43E-05 I			5.1E+03 N	5.2E-02 N	1.9E+02 N	2.9E+05 N	1.1E+04 N
MEPHOSFOLAN	950107	9.00E-05 H					3.3E+00 N	3.3E-01 N	1.2E-01 N	1.8E+02 N	7.0E+00 N
MEPIQUAT CHLORIDE	24307264	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
MERCURIC CHLORIDE	7487947	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
MERCURY (INORGANIC)	7439976			8.60E-05 I				3.1E-01 N			
METHYLMERCURY	22967926	1.00E-04 I					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
METHACRYLONITRILE	126987	1.00E-04 I		2.00E-04 A		y	1.0E+00 N	7.3E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
METHANOL	67561	5.00E-01 I					1.8E+04 N	1.8E+03 N	6.8E+02 N	1.0E+06 N	3.9E+04 N
METHIDATHION	950378	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
METHOXYCHLOR	72435	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
METHYL ACETATE	79209	1.00E+00 H				y	6.1E+03 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
METHYL ACRYLATE	96333	3.00E-02 A				y	1.8E+02 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
2-METHYLANILINE	95534		2.40E-01 H				2.8E-01 C	2.6E-02 C	1.3E-02 C	2.4E+01 C	2.7E+00 C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746	5.00E-04 I					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCPP)	93652	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
METHYLCYCLOHEXANE	108872			8.60E-01 H		y	6.3E+03 N	3.1E+03 N			
METHYLENE BROMIDE	74953	1.00E-02 A				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
METHYLENE CHLORIDE	75092	6.00E-02 I	7.50E-03 I	8.60E-01 H	1.65E-03 I	y	4.1E+00 C	3.8E+00 C	4.2E-01 C	7.6E+02 C	8.5E+01 C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144	7.00E-04 H	1.30E-01 H		1.30E-01 H		5.2E-01 C	4.8E-02 C	2.4E-02 C	4.4E+01 C	4.9E+00 C
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611		4.60E-02 I				1.5E+00 C	1.4E-01 C	6.9E-02 C	1.2E+02 C	1.4E+01 C
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			1.7E-04 I				6.2E-01 N			
METHYL ETHYL KETONE (2-BUTANONE)	78933	6.00E-01 I		2.86E-01 I		y	1.9E+03 N	1.0E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
METHYL HYDRAZINE	60344		1.10E+00 W				6.1E-02 C	5.7E-03 C	2.9E-03 C	5.2E+00 C	5.8E-01 C

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							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108101	8.00E-02 H		2.00E-02 A		y	1.4E+02 N	7.3E+01 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
METHYL METHACRYLATE	80626	1.40E+00 I		2.00E-01 I		y	1.4E+03 N	7.3E+02 N	1.9E+03 N	2.9E+06 N	1.1E+05 N
2-METHYL-5-NITROANILINE	99558		3.30E-02 H				2.0E+00 C	1.9E-01 C	9.6E-02 C	1.7E+02 C	1.9E+01 C
METHYL PARATHION	298000	2.50E-04 I					9.1E+00 N	9.1E-01 N	3.4E-01 N	5.1E+02 N	2.0E+01 N
2-METHYLPHENOL	95487	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
3-METHYLPHENOL	108394	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
4-METHYLPHENOL	106445	5.00E-03 H					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
METHYLSTYRENE MIX	25013154	6.00E-03 A		1.00E-02 A		y	5.5E+01 N	3.7E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
ALPHA-METHYLSTYRENE	98839	7.00E-02 A				y	4.3E+02 N	2.6E+02 N	9.5E+01 N	1.4E+05 N	5.5E+03 N
METHYL TERT-BUTYL ETHER	1634044			8.57E-01 I		y	6.3E+03 N	3.1E+03 N			
METOLACHLOR (DUAL)	51218452	1.50E-01 I					5.5E+03 N	5.5E+02 N	2.0E+02 N	3.1E+05 N	1.2E+04 N
MIREX	2385855	2.00E-04 I					7.3E+00 N	7.3E-01 N	2.7E-01 N	4.1E+02 N	1.6E+01 N
MOLYBDENUM	7439987	5E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
MONOCHLORAMINE	10599903	1E-01 I		1.00E-01 H			3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
NALED	300765	2E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
NICKEL REFINERY DUST					8.4E-01 I			7.5E-03 C			
NICKEL	7440020	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
NITRATE	14797558	1.60E+00 I					5.8E+04 N	5.8E+03 N	2.2E+03 N	3.3E+06 N	1.3E+05 N
NITRIC OXIDE	10102439	1.00E-01 W				y	6.1E+02 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
NITRITE	14797650	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
2-NITROANILINE	88744			5.70E-05 H				2.1E-01 N			
NITROBENZENE	98953	5.00E-04 I		6.00E-04 A		y	3.5E+00 N	2.2E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
NITROFURANTOIN	67209	7.00E-02 H					2.6E+03 N	2.6E+02 N	9.5E+01 N	1.4E+05 N	5.5E+03 N
NITROFURAZONE	59870		1.50E+00 H				4.5E-02 C	4.2E-03 C	2.1E-03 C	3.8E+00 C	4.3E-01 C
NITROGEN DIOXIDE	10102440	1.00E+00 W				y	6.1E+03 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
NITROGLYCERIN	55630		1.4E-02 E				4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C
4-NITROPHENOL	100027	8.00E-03 E					2.9E+02 N	2.9E+01 N	1.1E+01 N	1.6E+04 N	6.3E+02 N
2-NITROPROPANE	79469			5.70E-03 I	9.40E+00 H	y	1.3E-03 C	6.7E-04 C			
N-NITROSO-DI-N-BUTYLAMINE	924163		5.40E+00 I		5.60E+00 I	y	1.9E-03 C	1.1E-03 C	5.8E-04 C	1.1E+00 C	1.2E-01 C
N-NITROSODIETHANOLAMINE	1116547		2.80E+00 I				2.4E-02 C	2.2E-03 C	1.1E-03 C	2.0E+00 C	2.3E-01 C
N-NITROSODIETHYLAMINE	55185		1.50E+02 I		1.50E+02 I		4.5E-04 C	4.2E-05 C	2.1E-05 C	3.8E-02 C	4.3E-03 C
N-NITROSODIMETHYLAMINE	62759		5.10E+01 I		5.10E+01 I		1.3E-03 C	1.2E-04 C	6.2E-05 C	1.1E-01 C	1.3E-02 C
N-NITROSODIPHENYLAMINE	86306		4.90E-03 I				1.4E+01 C	1.3E+00 C	6.4E-01 C	1.2E+03 C	1.3E+02 C
N-NITROSODIPROPYLAMINE	621647		7.00E+00 I				9.6E-03 C	8.9E-04 C	4.5E-04 C	8.2E-01 C	9.1E-02 C
N-NITROSO-N-ETHYLUREA	759739		1.40E+02 H				4.8E-04 C	4.5E-05 C	2.3E-05 C	4.1E-02 C	4.6E-03 C
N-NITROSO-N-METHYLETHYLAMINE	10595956		2.20E+01 I				3.0E-03 C	2.8E-04 C	1.4E-04 C	2.6E-01 C	2.9E-02 C
N-NITROSOPYRROLIDINE	930552		2.10E+00 I		2.10E+00 I		3.2E-02 C	3.0E-03 C	1.5E-03 C	2.7E+00 C	3.0E-01 C
M-NITROTOLUENE	99081	2.00E-02 E				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
O-NITROTOLUENE	88722	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
P-NITROTOLUENE	99990	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
NUSTAR	85509199	7.00E-04 I					2.6E+01 N	2.6E+00 N	9.5E-01 N	1.4E+03 N	5.5E+01 N
ORYZALIN	19044883	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
OXADIAZON	19666309	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
OXAMYL	23135220	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
OXYFLUORFEN	42874033	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N

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Risk-based concentrations

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
PARAQUAT DICHLORIDE	1910425	4.50E-03 I					1.6E+02 N	1.6E+01 N	6.1E+00 N	9.2E+03 N	3.5E+02 N
PARATHION	56382	6.00E-03 H					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
PENTACHLOROBENZENE	608935	8.00E-04 I					2.9E+01 N	2.9E+00 N	1.1E+00 N	1.6E+03 N	6.3E+01 N
PENTACHLORONITROBENZENE	82688	3.00E-03 I	2.60E-01 H				2.6E-01 C	2.4E-02 C	1.2E-02 C	2.2E+01 C	2.5E+00 C
PENTACHLOROPHENOL	87865	3.00E-02 I	1.20E-01 I				5.6E-01 C	5.2E-02 C	2.6E-02 C	4.8E+01 C	5.3E+00 C
PERMETHRIN	52645531	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
PHENOL	108952	6.00E-01 I					2.2E+04 N	2.2E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
M-PHENYLENEDIAMINE	108452	6.00E-03 I					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
O-PHENYLENEDIAMINE	95545		4.70E-02 H				1.4E+00 C	1.3E-01 C	6.7E-02 C	1.2E+02 C	1.4E+01 C
P-PHENYLENEDIAMINE	106503	1.90E-01 H					6.9E+03 N	6.9E+02 N	2.6E+02 N	3.9E+05 N	1.5E+04 N
2-PHENYLPHENOL	90437		1.90E-03 H				3.5E+01 C	3.3E+00 C	1.7E+00 C	3.0E+03 C	3.4E+02 C
PHOSPHINE	7803512	3.00E-04 I		8.60E-05 I			1.1E+01 N	3.1E-01 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
PHOSPHORIC ACID	7664382			2.90E-03 I				1.1E+01 N			
PHOSPHORUS (WHITE)	7723140	2.00E-05 I					7.3E-01 N	7.3E-02 N	2.7E-02 N	4.1E+01 N	1.6E+00 N
P-PHTHALIC ACID	100210	1.00E+00 H					3.7E+04 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
PHTHALIC ANHYDRIDE	85449	2.00E+00 I		3.43E-02 H			7.3E+04 N	1.3E+02 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
POLYBROMINATED BIPHENYLS		7.00E-06 H	8.90E+00 H				7.5E-03 C	7.0E-04 C	3.5E-04 C	6.4E-01 C	7.2E-02 C !
POLYCHLORINATED BIPHENYLS	1336363		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1016	12674112	7.00E-05 I	7.00E-02 I		7.00E-02 I		9.6E-01 C !	8.9E-02 C !	4.5E-02 C !	8.2E+01 C !	5.5E+00 N
AROCLOR-1221	11104282		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1232	11141165		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1242	53469219		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1248	12672296		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1254	11097691	2.00E-05 I	2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C !
AROCLOR-1260	11096825		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
POLYCHLORINATED TERPHENYLS	61788338		4.50E+00 E				1.5E-02 C	1.4E-03 C	7.0E-04 C	1.3E+00 C	1.4E-01 C
POLYNUCLEAR AROMATIC HYDROCARBONS:											
ACENAPHTHENE	83329	6.00E-02 I				y	3.7E+02 N	2.2E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
ANTHRACENE	120127	3.00E-01 I				y	1.8E+03 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
BENZ[A]ANTHRACENE	56553		7.30E-01 E				9.2E-02 C	8.6E-03 C	4.3E-03 C	7.8E+00 C	8.7E-01 C
BENZO[B]FLUORANTHENE	205992		7.30E-01 E				9.2E-02 C	8.6E-03 C	4.3E-03 C	7.8E+00 C	8.7E-01 C
BENZO[K]FLUORANTHENE	207089		7.30E-02 E				9.2E-01 C	8.6E-02 C	4.3E-02 C	7.8E+01 C	8.7E+00 C
BENZO[A]PYRENE	50328		7.30E+00 I		3.10E+00 E		9.2E-03 C	2.0E-03 C	4.3E-04 C	7.8E-01 C	8.7E-02 C
CARBAZOLE	86748		2.00E-02 H				3.3E+00 C	3.1E-01 C	1.6E-01 C	2.9E+02 C	3.2E+01 C
CHRYSENE	218019		7.30E-03 E				9.2E+00 C	8.6E-01 C	4.3E-01 C	7.8E+02 C	8.7E+01 C
DIBENZ[A,H]ANTHRACENE	53703		7.30E+00 E				9.2E-03 C	8.6E-04 C	4.3E-04 C	7.8E-01 C	8.7E-02 C
DIBENZOFURAN	132649	4.00E-03 E				y	2.4E+01 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
FLUORANTHENE	206440	4.00E-02 I					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
FLUORENE	86737	4.00E-02 I				y	2.4E+02 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
INDENO[1,2,3-C,D]PYRENE	193395		7.30E-01 E				9.2E-02 C	8.6E-03 C	4.3E-03 C	7.8E+00 C	8.7E-01 C
2-METHYLNAPHTHALENE	91576	2.00E-02 E				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
NAPHTHALENE	91203	2.00E-02 I		9.00E-04 I		y	6.5E+00 N	3.3E+00 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
PYRENE	129000	3.00E-02 I				y	1.8E+02 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
PROMETON	1610180	1.50E-02 I					5.5E+02 N	5.5E+01 N	2.0E+01 N	3.1E+04 N	1.2E+03 N
PROMETRYN	7287196	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N

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							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
PROPACHLOR	1918167	1.30E-02 I					4.7E+02 N	4.7E+01 N	1.8E+01 N	2.7E+04 N	1.0E+03 N
PROPANIL	709988	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
PROPARGITE	2312358	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
N-PROPYLBENZENE		1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
PROPYLENE GLYCOL	57556	2.00E+01 H					7.3E+05 N	7.3E+04 N	2.7E+04 N	4.1E+07 N	1.6E+06 N
PROPYLENE GLYCOL, MONOETHYL ETHER	52125538	7.00E-01 H					2.6E+04 N	2.6E+03 N	9.5E+02 N	1.4E+06 N	5.5E+04 N
PROPYLENE GLYCOL, MONOMETHYL ETHER	107982	7.00E-01 H		5.70E-01 I			2.6E+04 N	2.1E+03 N	9.5E+02 N	1.4E+06 N	5.5E+04 N
PURSUIT	81335775	2.50E-01 I					9.1E+03 N	9.1E+02 N	3.4E+02 N	5.1E+05 N	2.0E+04 N
PYRIDINE	110861	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
QUINOLINE	91225		1.20E+01 H				5.6E-03 C	5.2E-04 C	2.6E-04 C	4.8E-01 C	5.3E-02 C
RDX	121824	3.00E-03 I	1.10E-01 I				6.1E-01 C	5.7E-02 C	2.9E-02 C	5.2E+01 C	5.8E+00 C
RESMETHRIN	10453868	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
RONNEL	299843	5.00E-02 H					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
ROTENONE	83794	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
SELENIOUS ACID	7783008	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
SELENIUM	7782492	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
SILVER	7440224	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
SIMAZINE	122349	5.00E-03 I	1.20E-01 H				5.6E-01 C	5.2E-02 C	2.6E-02 C	4.8E+01 C	5.3E+00 C
SODIUM AZIDE	26628228	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
SODIUM DIETHYLDITHIOCARBAMATE	148185	3.00E-02 I	2.70E-01 H				2.5E-01 C	2.3E-02 C	1.2E-02 C	2.1E+01 C	2.4E+00 C
STRONTIUM, STABLE	7440246	6.00E-01 I					2.2E+04 N	2.2E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
STRYCHNINE	57249	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
STYRENE	100425	2.00E-01 I		2.86E-01 I		y	1.6E+03 N	1.0E+03 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
2,3,7,8-TETRACHLORODIBENZODIOXIN	1746016		1.50E+05 H		1.50E+05 H		4.5E-07 C	4.2E-08 C	2.1E-08 C	3.8E-05 C	4.3E-06 C
1,2,4,5-TETRACHLOROBENZENE	95943	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
1,1,1,2-TETRACHLOROETHANE	630206	3.00E-02 I	2.60E-02 I		2.60E-02 I	y	4.1E-01 C	2.4E-01 C	1.2E-01 C	2.2E+02 C	2.5E+01 C
1,1,2,2-TETRACHLOROETHANE	79345	6.00E-02 E	2.00E-01 I		2.00E-01 I	y	5.3E-02 C	3.1E-02 C	1.6E-02 C	2.9E+01 C	3.2E+00 C
TETRACHLOROETHENE	127184	1.00E-02 I	5.20E-02 E	1.4E-01 E	2.00E-03 E	y	1.1E+00 C	3.1E+00 C	6.1E-02 C	1.1E+02 C	1.2E+01 C
2,3,4,6-TETRACHLOROPHENOL	58902	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
P,A,A,A-TETRACHLOROTOLUENE	5216251		2.00E+01 H				3.3E-03 C	3.1E-04 C	1.6E-04 C	2.9E-01 C	3.2E-02 C
1,1,1,2-TETRAFLUOROETHANE	811972			2.29E+01 I		y	1.7E+05 N	8.4E+04 N			
**TETRAHYDROFURAN	109999	2.00E-01 E	7.6E-03 E	8.6E-02 E	6.8E-03 E		8.8E+00 C	9.2E-01 C	4.2E-01 C	7.5E+02 C	8.4E+01 C
TETRYL	479458	1.00E-02 H					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
THALLIC OXIDE	1314325	7.00E-05 W					2.6E+00 N	2.6E-01 N	9.5E-02 N	1.4E+02 N	5.5E+00 N
THALLIUM	7440280	7.00E-05 O					2.6E+00 N	2.6E-01 N	9.5E-02 N	1.4E+02 N	5.5E+00 N
THALLIUM ACETATE	563688	9.00E-05 I					3.3E+00 N	3.3E-01 N	1.2E-01 N	1.8E+02 N	7.0E+00 N
THALLIUM CARBONATE	6533739	8.00E-05 I					2.9E+00 N	2.9E-01 N	1.1E-01 N	1.6E+02 N	6.3E+00 N
THALLIUM CHLORIDE	7791120	8.00E-05 I					2.9E+00 N	2.9E-01 N	1.1E-01 N	1.6E+02 N	6.3E+00 N
THALLIUM NITRATE	10102451	9.00E-05 I					3.3E+00 N	3.3E-01 N	1.2E-01 N	1.8E+02 N	7.0E+00 N
THALLIUM SULFATE (2:1)	7446186	8.00E-05 I					2.9E+00 N	2.9E-01 N	1.1E-01 N	1.6E+02 N	6.3E+00 N
THIOBENCARB	28249776	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
TIN	7440315	6.00E-01 H					2.2E+04 N	2.2E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 <

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
TITANIUM	7440326	4.00E+00 E		8.60E-03 E			1.5E+05 N	3.1E+01 N	5.4E+03 N	8.2E+06 N	3.1E+05 N
TITANIUM DIOXIDE	13463677	4.00E+00 E		8.60E-03 E			1.5E+05 N	3.1E+01 N	5.4E+03 N	8.2E+06 N	3.1E+05 N
TOLUENE	108883	2.00E-01 I		1.14E-01 I		y	7.5E+02 N	4.2E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
TOLUENE-2,4-DIAMINE	95807		3.20E+00 H				2.1E-02 C	2.0E-03 C	9.9E-04 C	1.8E+00 C	2.0E-01 C
TOLUENE-2,5-DIAMINE	95705	6.00E-01 H					2.2E+04 N	2.2E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
TOLUENE-2,6-DIAMINE	823405	2.00E-01 H					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
P-TOLUIDINE	106490		1.90E-01 H				3.5E-01 C	3.3E-02 C	1.7E-02 C	3.0E+01 C	3.4E+00 C
TOXAPHENE	8001352		1.10E+00 I		1.10E+00 I		6.1E-02 C	5.7E-03 C	2.9E-03 C	5.2E+00 C	5.8E-01 C
1,2,4-TRIBROMOBENZENE	615543	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
TRIBUTYLTIN OXIDE	56359	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
2,4,6-TRICHLOROANILINE	634935		3.40E-02 H				2.0E+00 C	1.8E-01 C	9.3E-02 C	1.7E+02 C	1.9E+01 C
1,2,4-TRICHLOROBENZENE	120821	1.00E-02 I		5.70E-02 H		y	1.9E+02 N	2.1E+02 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
1,1,1-TRICHLOROETHANE	71556	2.00E-02 E		2.86E-01 E		y	5.4E+02 N	1.0E+03 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
1,1,2-TRICHLOROETHANE	79005	4.00E-03 I	5.70E-02 I		5.60E-02 I	y	1.9E-01 C	1.1E-01 C	5.5E-02 C	1.0E+02 C	1.1E+01 C
TRICHLOROETHENE	79016	6.00E-03 E	1.10E-02 E		6.00E-03 E	y	1.6E+00 C	1.0E+00 C	2.9E-01 C	5.2E+02 C	5.8E+01 C !
TRICHLOROFLUOROMETHANE	75694	3.00E-01 I		2.00E-01 A		y	1.3E+03 N	7.3E+02 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
2,4,5-TRICHLOROPHENOL	95954	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
2,4,6-TRICHLOROPHENOL	88062		1.10E-02 I		1.00E-02 I		6.1E+00 C	6.3E-01 C	2.9E-01 C	5.2E+02 C	5.8E+01 C
2,4,5-T	93765	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID	93721	8.00E-03 I					2.9E+02 N	2.9E+01 N	1.1E+01 N	1.6E+04 N	6.3E+02 N
1,1,2-TRICHLOROPROPANE	598776	5.00E-03 I				y	3.0E+01 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
1,2,3-TRICHLOROPROPANE	96184	6.00E-03 I	7.00E+00 H			y	1.5E-03 C	8.9E-04 C	4.5E-04 C	8.2E-01 C	9.1E-02 C
1,2,3-TRICHLOROPROPENE	96195	5.00E-03 H				y	3.0E+01 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76131	3.00E+01 I		8.60E+00 H		y	5.9E+04 N	3.1E+04 N	4.1E+04 N	6.1E+07 N	2.3E+06 N
1,2,4-TRIMETHYLBENZENE	95636	5.00E-02 E		1.70E-03 E		y	1.2E+01 N	6.2E+00 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
1,3,5-TRIMETHYLBENZENE	108678	5.00E-02 E		1.70E-03 E		y	1.2E+01 N	6.2E+00 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
TRIMETHYL PHOSPHATE	512561		3.70E-02 H				1.8E+00 C	1.7E-01 C	8.5E-02 C	1.5E+02 C	1.7E+01 C
1,3,5-TRINITROBENZENE	99354	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
2,4,6-TRINITROTOLUENE	118967	5.00E-04 I	3.00E-02 I				2.2E+00 C !	2.1E-01 C !	1.1E-01 C !	1.9E+02 C !	2.1E+01 C !
URANIUM (SOLUBLE SALTS)		3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
VANADIUM	7440622	7.00E-03 H					2.6E+02 N	2.6E+01 N	9.5E+00 N	1.4E+04 N	5.5E+02 N
VANADIUM PENTOXIDE	1314621	9.00E-03 I					3.3E+02 N	3.3E+01 N	1.2E+01 N	1.8E+04 N	7.0E+02 N
VANADIUM SULFATE	16785812	2.00E-02 H					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
VINCLOZOLIN	50471448	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
VINYL ACETATE	108054	1.00E+00 H		5.71E-02 I		y	4.1E+02 N	2.1E+02 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
VINYL CHLORIDE	75014		1.90E+00 H		3.00E-01 H	y	1.9E-02 C	2.1E-02 C	1.7E-03 C	3.0E+00 C	3.4E-01 C
WARFARIN	81812	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
M-XYLENE	108383	2.00E+00 H				y	1.2E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
O-XYLENE	95476	2.00E+00 H				y	1.2E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
P-XYLENE	106423					y					
XYLENES	1330207	2.00E+00 I				y	1.2E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
ZINC	7440666	3.00E-01 I					1.1E+04 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
ZINC PHOSPHIDE	1314847	3E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
ZINEB	12122677	5E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N

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E = EPA-NCEA provisional value O = other		Region III SSLs		
		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
ACETALDEHYDE	75070	3.8E-04	7.7E-03	C
ACETOCHLOR	34256821			
ACETONE	67641	1.2E-01	2.5E+00	N
ACETONITRILE	75058	2.9E-02	5.8E-01	N
ACETOPHENONE	98862	1.1E-05	2.2E-04	N
ACROLEIN	107028	1.0E-05	2.0E-04	N
ACRYLAMIDE	79061	3.7E-06	7.4E-05	C
ACRYLONITRILE	107131	7.4E-06	1.5E-04	C
ALACHLOR	15972608	3.5E-04	7.0E-03	C
ALAR	1596845			
ALDICARB	116063	1.0E-02	2.1E-01	N
ALDICARB SULFONE	1646884	7.5E-03	1.5E-01	N
ALDRIN	309002	3.8E-04	7.7E-03	C
ALUMINUM	7429905			
AMINODINITROTOLUENES				
4-AMINOPYRIDINE	504245			
AMMONIA	7664417			
ANILINE	62533	6.8E-03	1.4E-01	C
ANTIMONY	7440360	6.6E-01	1.3E+01	N
ANTIMONY PENTOXIDE	1314609			
ANTIMONY TETROXIDE	1332816			
ANTIMONY TRIOXIDE	1309644			
ARSENIC	7440382	1.3E-03	2.6E-02	C
ARSINE	7784421			
ASSURE	76578148			
ATRAZINE	1912249	4.4E-04	8.8E-03	C
AZOBENZENE	103333	1.8E-03	3.5E-02	C
BARIUM	7440393	1.1E+02	2.1E+03	N
BAYGON	114261			
BAYTHROID	68359375			
BENTAZON	25057890			
BENZALDEHYDE	100527			
BENZENE	71432	1.0E-04	2.1E-03	C
BENZENETHIOL	108985			
BENZIDINE	92875			
BENZOIC ACID	65850			
BENZYL ALCOHOL	100516	4.4E+00	8.8E+01	N
BENZYL CHLORIDE	100447	1.9E-05	3.7E-04	C
BERYLLIUM	7440417	5.8E+01	1.2E+03	N
BIPHENYL	92524	4.8E+00	9.6E+01	N
BIS(2-CHLOROETHYL)ETHER	111444	2.2E-06	4.4E-05	C
BIS(2-CHLOROISOPROPYL)ETHER	108601	8.4E-05	1.7E-03	C
BIS(CHLOROMETHYL)ETHER	542881	9.7E-09	1.9E-07	C
BIS(2-ETHYLHEXYL)PHTHALATE	117817	1.4E+02	2.9E+03	C
BORON	7440428			

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		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
BROMODICHLOROMETHANE	75274	5.4E-05	1.1E-03	C
BROMOETHENE	593602	5.4E-05	1.1E-03	C
BROMOFORM	75252	2.0E-01	4.1E+00	C
BROMOMETHANE	74839	2.1E-03	4.1E-02	N
BROMOPHOS	2104963			
1,3-BUTADIENE	106990	3.9E-06	7.8E-05	C
1-BUTANOL	71363	7.8E-01	1.6E+01	N
BUTYLBENZYLPHTHALATE	85687	8.4E+02	1.7E+04	N
BUTYLATE	2008415			
N-BUTYLBENZENE	104518			
SEC-BUTYLBENZENE	135988			
TERT-BUTYLBENZENE	98066			
**CADMIUM-WATER	7440439	1.4E+00	2.7E+01	N
**CADMIUM-FOOD	7440439	2.7E+00	5.5E+01	N
CAPROLACTAM	105602			
CARBARYL	63252	1.5E+00	3.0E+01	N
CARBON DISULFIDE	75150	9.5E-01	1.9E+01	N
CARBON TETRACHLORIDE	56235	1.1E-04	2.1E-03	C
CARBOSULFAN	55285148			
CHLORAL	75876			
CHLORANIL	118752			
CHLORDANE	57749	4.6E-02	9.2E-01	C
**CHLORINE	7782505			
CHLORINE DIOXIDE	10049044			
CHLOROACETIC ACID	79118			
4-CHLOROANILINE	106478	4.8E-02	9.7E-01	N
CHLOROBENZENE	108907	4.0E-02	8.0E-01	N
CHLOROBENZILATE	510156	1.3E-03	2.7E-02	C
P-CHLOROBENZOIC ACID	74113			
2-CHLORO-1,3-BUTADIENE	126998	6.0E-03	1.2E-01	N
1-CHLOROBUTANE	109693	1.0E+00	2.0E+01	N
1-CHLORO-1,1-DIFLUOROETHANE	75683	7.0E+01	1.4E+03	N
CHLORODIFLUOROMETHANE	75456	7.0E+01	1.4E+03	N
CHLOROETHANE	75003	9.6E-04	1.9E-02	C
CHLOROFORM	67663	4.5E-05	8.9E-04	C
CHLOROMETHANE	74873	5.2E-04	1.0E-02	C
4-CHLORO-2-METHYLANILINE	95692			
BETA-CHLORONAPHTHALENE	91587	1.6E+00	3.2E+01	N
O-CHLORONITROBENZENE	88733			
P-CHLORONITROBENZENE	100005			
2-CHLOROPHENOL	95578			
2-CHLOROPROPANE	75296	6.6E-02	1.3E+00	N
O-CHLOROTOLUENE	95498	6.5E-02	1.3E+00	N
CHLORPYRIFOS	2921882	3.2E+00	6.3E+01	N
CHLORPYRIFOS-METHYL	5598130			

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		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
CHROMIUM III	16065831	9.9E+07	2.0E+09	N
CHROMIUM VI	18540299	2.1E+00	4.2E+01	N
COBALT	7440484			
COKE OVEN EMISSIONS (COAL TAR)	8007452			
COPPER	7440508	5.3E+02	1.1E+04	N
CROTONALDEHYDE	123739	1.5E-05	3.1E-04	C
CUMENE	98828	3.2E+00	6.4E+01	N
CYANIDE (FREE)	57125	7.4E+00	1.5E+02	N
CALCIUM CYANIDE	592018			
COPPER CYANIDE	544923			
CYANAZINE	21725462	2.6E-05	5.3E-04	C
CYANOGEN	460195			
CYANOGEN BROMIDE	506683			
CYANOGEN CHLORIDE	506774			
HYDROGEN CYANIDE	74908	1.1E-01	2.2E+00	N
POTASSIUM CYANIDE	151508			
POTASSIUM SILVER CYANIDE	506616			
SILVER CYANIDE	506649	3.1E+01	6.2E+02	N
SODIUM CYANIDE	143339			
**THIOCYANATE				
ZINC CYANIDE	557211	1.1E+02	2.3E+03	N
CYCLOHEXANONE	108941	6.1E+01	1.2E+03	N
CYHALOTHRIN/KARATE	68085858			
CYPERMETHRIN	52315078			
DACTHAL	1861321			
DALAPON	75990	3.5E-01	7.1E+00	N
DDD	72548	5.6E-01	1.1E+01	C
DDE	72559	1.8E+00	3.5E+01	C
DDT	50293	5.8E-02	1.2E+00	C
DIAZINON	333415	2.1E-02	4.3E-01	N
DIBENZOFURAN	132649	3.8E-01	7.7E+00	N
1,4-DIBROMOBENZENE	106376			
DIBROMOCHLOROMETHANE	124481	4.1E-05	8.3E-04	C
1,2-DIBROMO-3-CHLOROPROPANE	96128	4.4E-05	8.7E-04	C
1,2-DIBROMOETHANE	106934	4.3E-07	8.5E-06	C
DIBUTYLPHTHALATE	84742	2.5E+02	5.0E+03	N
DICAMBA	1918009	2.2E-01	4.5E+00	N
**1,2-DICHLOROBENZENE	95501	4.6E-01	9.3E+00	N
1,3-DICHLOROBENZENE	541731	4.4E-03	8.7E-02	N
1,4-DICHLOROBENZENE	106467	3.6E-04	7.1E-03	C
3,3'-DICHLOROBENZIDINE	91941	2.5E-04	4.9E-03	C
1,4-DICHLORO-2-BUTENE	764410	4.0E-07	8.0E-06	C
DICHLORODIFLUOROMETHANE	75718	5.5E-01	1.1E+01	N
1,1-DICHLOROETHANE	75343	2.3E-01	4.5E+00	N
1,2-DICHLOROETHANE	107062	5.2E-05	1.0E-03	C

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Chemical	CAS	DAF 1 mg/kg	DAF 20 mg/kg	
1,1-DICHLOROETHENE	75354	1.8E-05	3.6E-04	C
CIS-1,2-DICHLOROETHENE	156592	1.7E-02	3.5E-01	N
TRANS-1,2-DICHLOROETHENE	156605	4.1E-02	8.2E-01	N
TOTAL 1,2-DICHLOROETHENE	540590	1.9E-02	3.7E-01	N
2,4-DICHLOROPHENOL	120832	6.0E-02	1.2E+00	N
2,4-D	94757	4.5E-01	9.0E+00	N
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826			
1,2-DICHLOROPROPANE	78875	1.0E-04	2.1E-03	C
2,3-DICHLOROPROPANOL	616239			
1,3-DICHLOROPROPENE	542756	2.7E-05	5.5E-04	C
DICHLORVOS	62737	5.5E-05	1.1E-03	C
DICOFOL	115322	9.3E-04	1.9E-02	C
DICYCLOPENTADIENE	77736			
DIELDRIN	60571	1.1E-04	2.2E-03	C
DIESEL EMISSIONS				
DIETHYLPHTHALATE	84662	2.3E+01	4.5E+02	N
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900			
DI(2-ETHYLHEXYL)ADIPATE	103231			
DIETHYLSTILBESTROL	56531			
DIFENZOQUAT (AVENGE)	43222486			
1,1-DIFLUOROETHANE	75376			
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756			
3,3'-DIMETHOXYBENZIDINE	119904			
DIMETHYLAMINE	124403	8.5E-06	1.7E-04	N
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964			
2,4-DIMETHYLANILINE	95681			
N,N-DIMETHYLANILINE	121697			
3,3'-DIMETHYLBENZIDINE	119937			
1,1-DIMETHYLHYDRAZINE	57147			
1,2-DIMETHYLHYDRAZINE	540738			
2,4-DIMETHYLPHENOL	105679	3.4E-01	6.7E+00	N
2,6-DIMETHYLPHENOL	576261			
3,4-DIMETHYLPHENOL	95658			
DIMETHYLPHTHALATE	131113			
1,2-DINITROBENZENE	528290			
1,3-DINITROBENZENE	99650	1.8E-03	3.7E-02	N
1,4-DINITROBENZENE	100254			
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895			
4,6-DINITRO-2-METHYLPHENOL	534521			
2,4-DINITROPHENOL	51285			
DINITROTOLUENE MIX				
2,4-DINITROTOLUENE	121142	2.9E-02	5.7E-01	N
2,6-DINITROTOLUENE	606202	1.2E-02	2.5E-01	N
DINOSEB	88857	8.7E-03	1.7E-01	N

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		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
DIOCTYLPHTHALATE	117840	1.2E+05	2.4E+06	N
1,4-DIOXANE	123911	1.3E-03	2.6E-02	C
DIPHENYLAMINE	122394	1.3E+00	2.5E+01	N
1,2-DIPHENYLHYDRAZINE	122667	1.3E-04	2.5E-03	C
DIQUAT	85007	1.7E-02	3.3E-01	N
DISULFOTON	298044	3.2E-03	6.4E-02	N
1,4-DITHIANE	505293			
DIURON	330541	5.8E-02	1.2E+00	N
ENDOSULFAN	115297	9.8E-01	2.0E+01	N
ENDRIN	72208	2.7E-01	5.4E+00	N
EPICHLOROHYDRIN	106898	4.2E-04	8.4E-03	N
ETHION	563122	3.2E-01	6.4E+00	N
2-ETHOXYETHANOL	110805	3.3E+00	6.5E+01	N
ETHYL ACETATE	141786	1.7E+00	3.5E+01	N
ETHYLBENZENE	100414	7.5E-01	1.5E+01	N
ETHYLENE DIAMINE	107153			
ETHYLENE GLYCOL	107211	1.5E+01	3.0E+02	N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762			
ETHYLENE OXIDE	75218	4.8E-06	9.5E-05	C
ETHYLENE THIOUREA	96457			
ETHYL ETHER	60297	4.2E-01	8.5E+00	N
ETHYL METHACRYLATE	97632	1.0E+00	2.1E+01	N
FENAMIPHOS	22224926	7.8E-03	1.6E-01	N
FLUOMETURON	2164172			
FLUORINE	7782414			
FOMESAFEN	72178020			
FONOFOS	944229	1.8E-01	3.5E+00	N
FORMALDEHYDE	50000	1.5E+00	3.0E+01	N
FORMIC ACID	64186			
FURAN	110009	1.5E-03	3.0E-02	N
FURAZOLIDONE	67458			
FURFURAL	98011	2.3E-02	4.6E-01	N
GLYCIDALDEHYDE	765344			
GLYPHOSATE	1071836	2.6E+01	5.3E+02	N
HEPTACHLOR	76448	4.2E-02	8.4E-01	C
HEPTACHLOR EPOXIDE	1024573	1.2E-03	2.5E-02	C
HEXABROMOBENZENE	87821			
HEXACHLOROBENZENE	118741	2.6E-03	5.2E-02	C
HEXACHLOROBUTADIENE	87683	9.2E-02	1.8E+00	C
ALPHA-HCH	319846	4.5E-05	8.9E-04	C
BETA-HCH	319857	1.6E-04	3.1E-03	C
GAMMA-HCH (LINDANE)	58899	2.2E-04	4.3E-03	C
TECHNICAL HCH	608731			
HEXACHLOROCYCLOPENTADIENE	77474	1.0E+02	2.0E+03	N
HEXACHLORODIBENZODIOXIN MIX	19408743			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRI BC-c E = EPA-NCEA provisional value O = other		Region III SSLs Soil, for groundwater mig		
Chemical	CAS	DAF 1 mg/kg	DAF 20 mg/kg	
HEXACHLOROETHANE	67721	1.8E-02	3.6E-01	C
HEXACHLOROPHENE	70304	1.0E+02	2.0E+03	N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			
HEXANE	110543	6.9E-01	1.4E+01	N
2-HEXANONE	591786			
HEXAZINONE	51235042			
HMX	2691410			
HYDRAZINE	302012			
HYDROGEN CHLORIDE	7647010			
HYDROGEN SULFIDE	7783064			
HYDROQUINONE	123319			
IRON	7439896			
ISOBUTANOL	78831	5.9E-01	1.2E+01	N
ISOPHORONE	78591	2.1E-02	4.1E-01	C
ISOPROPALIN	33820530			
ISOPROPYL METHYL PHOSPHONIC ACID	1832548			
TETRAETHYLLEAD	78002	4.6E-05	9.2E-04	N
LITHIUM	7439932			
MALATHION	121755	4.0E-01	8.1E+00	N
MALEIC ANHYDRIDE	108316			
MANGANESE-NONFOOD	7439965	4.8E+01	9.5E+02	N
MANGANESE-FOOD	7439965	3.3E+02	6.7E+03	N
MEPHOSFOLAN	950107			
MEPIQUAT CHLORIDE	24307264			
MERCURIC CHLORIDE	7487947			
MERCURY (INORGANIC)	7439976			
METHYLMERCURY	22967926			
METHACRYLONITRILE	126987	2.1E-04	4.2E-03	N
METHANOL	67561	3.8E+00	7.5E+01	N
METHIDATHION	950378			
METHOXYCHLOR	72435	1.5E+01	3.1E+02	N
METHYL ACETATE	79209	1.2E+00	2.5E+01	N
METHYL ACRYLATE	96333	5.0E-01	1.0E+01	N
2-METHYLANILINE	95534	2.8E-04	5.7E-03	C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815			
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746			
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCPP)	93652			
METHYLCYCLOHEXANE	108872			
METHYLENE BROMIDE	74953	1.5E-02	3.0E-01	N
METHYLENE CHLORIDE	75092	9.5E-04	1.9E-02	C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144			
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611			
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			
METHYL ETHYL KETONE (2-BUTANONE)	78933	4.0E-01	7.9E+00	N
METHYL HYDRAZINE	60344			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRI E = EPA-NCEA provisional value O = other		BC-c Region III SSLs		
		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108101	6.5E-02	1.3E+00	N
METHYL METHACRYLATE	80626	3.2E-01	6.5E+00	N
2-METHYL-5-NITROANILINE	99558			
METHYL PARATHION	298000	4.3E-03	8.5E-02	N
2-METHYLPHENOL	95487			
3-METHYLPHENOL	108394			
4-METHYLPHENOL	106445			
METHYLSTYRENE MIX	25013154	5.1E-02	1.0E+00	N
ALPHA-METHYLSTYRENE	98839	4.0E-01	7.9E+00	N
METHYL TERT-BUTYL ETHER	1634044	1.4E+00	2.8E+01	N
METOLACHLOR (DUAL)	51218452			
MIREX	2385855			
MOLYBDENUM	7439987			
MONOCHLORAMINE	10599903			
NALED	300765			
NICKEL REFINERY DUST				
NICKEL	7440020			
NITRATE	14797558			
NITRIC OXIDE	10102439			
NITRITE	14797650			
2-NITROANILINE	88744			
NITROBENZENE	98953	1.2E-03	2.3E-02	N
NITROFURANTOIN	67209			
NITROFURAZONE	59870			
NITROGEN DIOXIDE	10102440			
NITROGLYCERIN	55630			
4-NITROPHENOL	100027	8.7E-02	1.7E+00	N
2-NITROPROPANE	79469	3.2E-07	6.4E-06	C
N-NITROSO-DI-N-BUTYLAMINE	924163	1.4E-06	2.7E-05	C
N-NITROSODIETHANOLAMINE	1116547			
N-NITROSODIETHYLAMINE	55185	1.1E-07	2.3E-06	C
N-NITROSODIMETHYLAMINE	62759	2.8E-07	5.7E-06	C
N-NITROSODIPHENYLAMINE	86306	3.8E-02	7.6E-01	C
N-NITROSODIPROPYLAMINE	621647	2.4E-06	4.7E-05	C
N-NITROSO-N-ETHYLUREA	759739			
N-NITROSO-N-METHYLETHYLAMINE	10595956			
N-NITROSOPYRROLIDINE	930552			
M-NITROTOLUENE	99081			
O-NITROTOLUENE	88722			
P-NITROTOLUENE	99990			
NUSTAR	85509199			
ORYZALIN	19044883			
OXADIAZON	19666309			
OXAMYL	23135220	1.9E-01	3.8E+00	N
OXYFLUORFEN	42874033			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRI BC-c E = EPA-NCEA provisional value O = other		Region III SSLs		
		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
PARAQUAT DICHLORIDE	1910425			
PARATHION	56382	5.0E-01	1.0E+01	N
PENTACHLOROBENZENE	608935	1.0E+00	2.0E+01	N
PENTACHLORONITROBENZENE	82688	4.1E-03	8.2E-02	C
PENTACHLOROPHENOL	87865			
PERMETHRIN	52645531	1.2E+02	2.4E+03	N
PHENOL	108952	6.7E+00	1.3E+02	N
M-PHENYLENEDIAMINE	108452	4.9E-02	9.8E-01	N
O-PHENYLENEDIAMINE	95545			
P-PHENYLENEDIAMINE	106503			
2-PHENYLPHENOL	90437			
PHOSPHINE	7803512			
PHOSPHORIC ACID	7664382			
PHOSPHORUS (WHITE)	7723140			
P-PHTHALIC ACID	100210			
PHTHALIC ANHYDRIDE	85449	2.6E+01	5.2E+02	N
POLYBROMINATED BIPHENYLS				
POLYCHLORINATED BIPHENYLS	1336363	2.1E-02	4.1E-01	C
AROCLOR-1016	12674112	2.1E-01	4.2E+00	C
AROCLOR-1221	11104282			
AROCLOR-1232	11141165			
AROCLOR-1242	53469219			
AROCLOR-1248	12672296			
AROCLOR-1254	11097691	5.4E-02	1.1E+00	C
AROCLOR-1260	11096825			
POLYCHLORINATED TERPHENYLS	61788338			
POLYNUCLEAR AROMATIC HYDROCARBONS:				
ACENAPHTHENE	83329	5.2E+00	1.0E+02	N
ANTHRACENE	120127	2.3E+01	4.7E+02	N
BENZ[A]ANTHRACENE	56553	7.3E-02	1.5E+00	C
BENZO[B]FLUORANTHENE	205992	2.3E-01	4.5E+00	C
BENZO[K]FLUORANTHENE	207089	2.3E+00	4.5E+01	C
BENZO[A]PYRENE	50328	1.9E-02	3.7E-01	C
CARBAZOLE	86748	2.3E-02	4.7E-01	C
CHRYSENE	218019	7.3E+00	1.5E+02	C
DIBENZ[A,H]ANTHRACENE	53703	7.0E-02	1.4E+00	C
DIBENZOFURAN	132649	3.8E-01	7.7E+00	N
FLUORANTHENE	206440	3.1E+02	6.3E+03	N
FLUORENE	86737	6.8E+00	1.4E+02	N
INDENO[1,2,3-C,D]PYRENE	193395	6.4E-01	1.3E+01	C
2-METHYLNAPHTHALENE	91576	1.1E+00	2.2E+01	N
NAPHTHALENE	91203	7.7E-03	1.5E-01	N
PYRENE	129000	3.4E+01	6.8E+02	N
PROMETON	1610180			
PROMETRYN	7287196			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRI		BC-c		
E = EPA-NCEA provisional value O = other		Region III SSLs		
		Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
PROPACHLOR	1918167			
PROPANIL	709988			
PROPARGITE	2312358			
N-PROPYLBENZENE		3.6E-01	7.1E+00	N
PROPYLENE GLYCOL	57556			
PROPYLENE GLYCOL, MONOETHYL ETHER	52125538			
PROPYLENE GLYCOL, MONOMETHYL ETHER	107982			
PURSUIT	81335775			
PYRIDINE	110861			
QUINOLINE	91225			
RDX	121824			
RESMETHRIN	10453868			
RONNEL	299843			
ROTENONE	83794			
SELENIOUS ACID	7783008			
SELENIUM	7782492	9.5E-01	1.9E+01	N
SILVER	7440224	1.6E+00	3.1E+01	N
SIMAZINE	122349	1.7E-04	3.3E-03	C
SODIUM AZIDE	26628228			
SODIUM DIETHYLDITHIOCARBAMATE	148185			
STRONTIUM, STABLE	7440246	7.7E+02	1.5E+04	N
STRYCHNINE	57249	8.3E-03	1.7E-01	N
STYRENE	100425	2.9E+00	5.7E+01	N
2,3,7,8-TETRACHLORODIBENZODIOXIN	1746016	4.3E-07	8.6E-06	C
1,2,4,5-TETRACHLOROBENZENE	95943	3.3E-02	6.6E-01	N
1,1,1,2-TETRACHLOROETHANE	630206	2.0E-04	4.0E-03	C
1,1,2,2-TETRACHLOROETHANE	79345	3.4E-05	6.8E-04	C
TETRACHLOROETHENE	127184	2.4E-03	4.8E-02	C
2,3,4,6-TETRACHLOROPHENOL	58902			
P,A,A,A-TETRACHLOROTOLUENE	5216251			
1,1,1,2-TETRAFLUOROETHANE	811972			
**TETRAHYDROFURAN	109999			
TETRYL	479458			
THALLIC OXIDE	1314325			
THALLIUM	7440280	1.8E-01	3.6E+00	N
THALLIUM ACETATE	563688			
THALLIUM CARBONATE	6533739			
THALLIUM CHLORIDE	7791120			
THALLIUM NITRATE	10102451			
THALLIUM SULFATE (2:1)	7446186			
THIOBENCARB	28249776			
TIN	7440315			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRI E = EPA-NCEA provisional value O = other		Region III SSLs Soil, for groundwater mig		
		DAF 1	DAF 20	
Chemical	CAS	mg/kg	mg/kg	
TITANIUM	7440326			
TITANIUM DIOXIDE	13463677			
TOLUENE	108883	4.4E-01	8.8E+00	N
TOLUENE-2,4-DIAMINE	95807			
TOLUENE-2,5-DIAMINE	95705			
TOLUENE-2,6-DIAMINE	823405			
P-TOLUIDINE	106490	3.0E-04	5.9E-03	C
TOXAPHENE	8001352	3.1E-02	6.3E-01	C
1,2,4-TRIBROMOBENZENE	615543			
TRIBUTYLTIN OXIDE	56359			
2,4,6-TRICHLOROANILINE	634935			
1,2,4-TRICHLOROBENZENE	120821	3.8E-01	7.5E+00	N
1,1,1-TRICHLOROETHANE	71556	5.1E-01	1.0E+01	N
1,1,2-TRICHLOROETHANE	79005	3.9E-05	7.8E-04	C
TRICHLOROETHENE	79016	7.7E-04	1.5E-02	C
TRICHLOROFLUOROMETHANE	75694	1.1E+00	2.3E+01	N
2,4,5-TRICHLOROPHENOL	95954			
2,4,6-TRICHLOROPHENOL	88062			
2,4,5-T	93765	9.8E-02	2.0E+00	N
2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID	93721	1.1E+00	2.1E+01	N
1,1,2-TRICHLOROPROPANE	598776	1.2E-02	2.5E-01	N
1,2,3-TRICHLOROPROPANE	96184	5.2E-07	1.0E-05	C
1,2,3-TRICHLOROPROPENE	96195	1.2E-02	2.5E-01	N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76131	1.2E+02	2.3E+03	N
1,2,4-TRIMETHYLBENZENE	95636			
1,3,5-TRIMETHYLBENZENE	108678			
TRIMETHYL PHOSPHATE	512561			
1,3,5-TRINITROBENZENE	99354			
2,4,6-TRINITROTOLUENE	118967			
URANIUM (SOLUBLE SALTS)				
VANADIUM	7440622	2.6E+02	5.1E+03	N
VANADIUM PENTOXIDE	1314621			
VANADIUM SULFATE	16785812			
VINCLOZOLIN	50471448			
VINYL ACETATE	108054	8.7E-02	1.7E+00	N
VINYL CHLORIDE	75014	7.9E-06	1.6E-04	C
WARFARIN	81812	2.2E-02	4.4E-01	N
M-XYLENE	108383	1.3E+01	2.5E+02	N
O-XYLENE	95476	1.1E+01	2.3E+02	N
P-XYLENE	106423			
XYLENES	1330207	8.5E+00	1.7E+02	N
ZINC	7440666	6.8E+02	1.4E+04	N
ZINC PHOSPHIDE	1314847			
ZINEB	12122677			

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.0016 Task ~~0000~~11 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-38

Sample I.D. 990621-BT-1W-SL0038 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1435 End 1500

Weather P/C 80's

Site Description 20 yds. south of main building. 50 ft. west of MW-3

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless steel bowl + spoon

Depth – Moisture Content moist

Color reddish brown Odor no odor

Description clay w/ limestone fragments

ANALYSES REQUIRED	CONTAINER DESCRIPTION
	From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore™ Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.0016 Task 000011 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name mw-39

Sample I.D. 990621-BT-1W-SL0039 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1515 End 1600

Weather P/c 80's

Site Description 20 yards east of main building

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless Steel Bowl + Spoon

Depth - Moisture Content saturated

Color yellowish brown Odor no odor

Description clay

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore^{TM} Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.0016 Task 000Ø11 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-40

Sample I.D. 990621-BT-1W-SL0040 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1610 End 1630

Weather p/c 80's

Site Description SE corner of BTF Plant

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless Steel Bowl + Spoon

Depth – Moisture Content saturated

Color moderate reddish brown Odor no odor

Description CLAY

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore™ Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.00\16 Task 000~~0~~11 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-41

Sample I.D. 990621 - BT - IW - SL0041 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1400 End 1415

Weather P/C 80's

Site Description South of BTF area near drip leg

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless steel bowl and spoon

Depth — Moisture Content moist to wet

Color grayish black Odor strong odor

Description limestone fragments w/ clay, little sand

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M ___
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore™ Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.00\16 Task 000011 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-42

Sample I.D. 990621-BT-IW-SL0042 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1355 End 1405

Weather P/C 80's

Site Description South of BTF area near drip leg

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless steel bowl and spoon

Depth N/A Moisture Content damp

Color grayish black Odor no odor

Description limestone fragments w/ clay, little sand

ANALYSES REQUIRED	CONTAINER DESCRIPTION
	From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore™ Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

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SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.0016 Task 0000/11 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-43

Sample I.D. ~~990619~~ 990621-BT-IW-SL0043 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1335 End 1345

Weather P/C 80's

Site Description South of BTF area near drip leg.

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ As Stainless steel spoon and bowl

Depth N/A Moisture Content moist

Color dark grey Odor no odor

Description lime rock cuttings w/ clay

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore™ Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel

ARCADIS
GERAGHTY & MILLER

SOIL/SEDIMENT SAMPLING LOG

Project Number TF000320.0016 Task 0000 11 Page 1 of 1

Site Location Sloss Industries, Birmingham, Alabama Location Name MW-44

Sample I.D. 990621-BT-IW-SL0044 KB 12/15/99 Coded/ Replicate No.

Date 6/21/99 Time of Sampling: Begin 1645 End 1710

Weather P/C 80's

Site Description NE corner of plant

SAMPLING DATA

Collection Method ~~Splitspoon Sampler~~ Stainless Steel Bowl + Spoon

Depth - Moisture Content Slightly moist

Color reddish brown Odor no odor

Description ~~NE corner of BTF area~~
CLAY w/ limestone fragments

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore^{TM} Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel AS/JK

ARCADIS
GERAGHTY & MILLER

SOIL/SEDIMENT SAMPLING LOG

Project Number: TF000320.0016 Task 0000/11 — Page 1 of 1

Site Location: Sloss Industries, Birmingham, Alabama — Location Name: Decon Pad Cuttings

Sample I.D.: 990621 - BT - IW - SL00~~X~~0 (KB 12/15/99) — Coded/ Replicate No.:

Date: 6 /21/99 — Time of Sampling: Begin 1730 End 1745

Weather: P/C 80's

Site Description: Decon pad area

SAMPLING DATA

Collection Method: ~~Splitspoon Sampler~~ Stainless Steel Bowl + Spoon

Depth: –

Moisture Content: slightly moist

Color: reddish brown

Odor: no odor

Description: CLAY w/ limestone fragments

ANALYSES REQUIRED	CONTAINER DESCRIPTION From Lab X or G&M
(6010, 7060, 7471, 7740, 7841) Priority Pollutant Metals & Barium	Plastic wide mouth
VOCs (8260B)	2 Encore^{TM} Samplers, 1 X 4oz (% Moisture)
SVOCs (8270C)	2 X 4 oz
Cyanide (9010/9014)	1 X 4 oz

Remarks: Non VOC's were composited in stainless steel bowl with stainless steel spoon.

Sampling Personnel: AS/JK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET S.W.
ATLANTA, GEORGIA 30303-8960

JAN 20 2000

4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Charles A. Jones
Director of Environmental Affairs
Sloss Industries Corporation
Post office Box 5327
3500 35th Avenue North
Birmingham, Alabama 33618

SUBJ: EPA Approval of RCRA Facility Investigation (RFI) Investigation Derived Waste (IDW) Report for Sloss Industries Corporation, Birmingham, Alabama
EPA ID Number ALD 000 828 848

Dear Mr. Jones:

The purpose of this letter is to respond to the *Draft RFI Chemical Manufacturing Plant IDW Report (Volume II)* for Sloss Industries Corporation, located in Birmingham, Alabama. This document, dated December 21, 1999, was prepared by ARCADIS Geraghty & Miller, Inc.

Based upon EPA's review, the aforementioned report is hereby approved.

Please note that two (2) copies of all RFI documents submitted shall be sent to the Region 4 Project Coordinator at the following address:

Carlos E. Merizalde
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch
Waste Management Division
U.S. EPA, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

Also, one (1) copy of all RFI documents shall be sent to ADEM's Hazardous Waste Branch at the following address:

William G. Hardy, Director
Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

Should you have any questions, please contact Mr. Carlos E. Merizalde, of my staff, at (404) 562-8606.

Sincerely,

Jeffrey T. Pallas, Chief
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch

cc: William G. Hardy, ADEM

File Copy

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
14497 North Dale Mabry Hwy.
Suite 115
Tampa
Florida 33618
Tel 813 961 1921
Fax 813 961 2599

ENVIRONMENTAL

Mr. Carlos Merizalde
United States Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303

Subject:
Project Status and Proposed Schedule
Sloss Industries Corporation - Birmingham, Alabama
EPA I.D. Number ALD 000 828 848

Tampa, FL,
4 February 2000

Contact:
Pedro Fierro

Extension:
(813) 264-3453

Dear Mr. Merizalde:

On behalf of Sloss Industries Corporation (Sloss), ARCADIS Geraghty & Miller is providing this schedule summary for your information and planning purposes. The summary is divided according to our previous submission milestones for convenience.

<u>Summary</u>

<u>Facility-Wide Investigation</u>

Sloss provided a response to comments document dated July 7, 1999. Based upon EPA comments, Sloss proposes to finalize this document and place a copy in the local repository.

<u>Coke Manufacturing Plant</u>

Sloss provided a response to comments document dated July 7, 1999.

<u>Land Disposal Areas</u>

Sloss provided a response to comments document dated July 7, 1999. An addendum to the responses dated November 19, 1999 was provided to EPA to provide additional information for your review.

<u>Biological Treatment Facility (BTF) and Sewers</u>

Sloss provided the draft RFI report dated February 8, 1999 to EPA for review. An addendum report dated October 29, 1999 was subsequently provided with additional information for your review.

Our ref.:
G:\[illegible]\TF320\lt\meri020400

Chemical Manufacturing Plant

Sloss provided the draft RFI report dated December 21, 1999 to EPA for review.

Proposed Schedule

Based upon our understanding of the site and the data available at this time, the draft RFI report for the Chemical Manufacturing Plant included a recommendation relative to further investigations at the facility. We have proposed that the groundwater evaluation requested by the EPA associated with the Facility-Wide RFI which recommends installing wells at the Chemical Manufacturing Plant and the Coke Plant be combined with the additional assessment of the groundwater conditions at the Chemical Plant. This recommendation is based upon the physical proximity of the two plants and the ability to optimize the investigative efforts. These activities are tentatively scheduled to commence in June 2000. Additional investigations that may be required for the Land Disposal Areas and the BTF and Sewers would be contemplated for June 2001.

In the interest of meeting this schedule and expediting the overall process, Sloss suggests a meeting between your technical reviewers and ARCADIS Geraghty & Miller's technical staff. The goal of this meeting would be to focus on the various aspects of the investigative efforts that need to be conducted at the Coke Plant and the Chemical Manufacturing Plant. Upon reaching a consensus, Sloss would be prepared to implement the schedule suggested above.

Please feel free to contact Mike Griffin, Sloss Industries, or myself at your convenience to discuss how we should proceed.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

Pedro Fierro, Jr.
Associate

Copies:
William G. Hardy, ADEM
Mike Griffin

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

MAR 06 2000

4WD-RCRA

Mr. Steve Cobb, Chief
Hazardous Waste Branch
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

SUBJ: Confirmation of Agency Lead for RCRA Corrective Action Facilities in Alabama.

Dear Mr. Cobb:

Pursuant to the discussion on Wednesday, February 9, 2000, at the Alabama annual review, the Environmental Protection Agency (EPA) Region 4 and Alabama Department of Environmental Management (ADEM) have agreed that the following Government Performance Results Act (GPRA) Corrective Action facilities will become and/or remain ADEM lead facilities for all corrective action:

Gulf States Steel	ALD004014973
Koppers Industries	ALD000771949
Stallworth Timber	ALD058223371
USX Corporation	ALD002904506

EPA has and will retain the lead on the following GPRA Corrective Action facilities:

Sloss Industries	ALD000828848
Wolverine Tube, Inc.	ALD053363776

Furthermore, EPA remains the lead on the following non-GPRA facility:

Union Foundry Company	ALD047158266

If you have any questions please contact me at (404) 562-8568, or Jeffrey Pallas, of my staff, at (404) 562-8569.

Sincerely,

Jewell Grubbs, Chief
RCRA Enforcement and Compliance Branch
Waste Management Division

cc: Mr. Gerald Hardy, ADEM

File copy

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
14497 North Dale Mabry Hwy.
Suite 115
Tampa
Florida 33618
Tel 813 961 1921
Fax 813 961 2599

ENVIRONMENTAL

MAY 2000
RECEIVED
LAND DIVISION

Mr. Carlos Merizalde
United States Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303

Subject:
Revisions to Proposed Phase II Coke Manufacturing Plant and Chemical Manufacturing Plant RFI Scope of Work
Sloss Industries Corporation - Birmingham, Alabama
EPA I.D. Number ALD 000 828 848

Tampa, FL,
10 May 2000

Contact:
Pedro Fierro

Extension:
(813) 264-3453

Dear Mr. Merizalde:

On behalf of Sloss Industries Corporation (Sloss), ARCADIS Geraghty & Miller is providing the attached revised Table 1 and Figure 1, which summarize the proposed Phase II Coke Manufacturing Plant and Chemical Manufacturing Plant RFI field work. As discussed in our April 12, 2000 meeting, proposed monitor wells MW-57S and MW-57D, which were located approximately 1800 ft southwest of P-13D, have been moved to the onsite piezometer P-14 location. Rather than installing a new shallow monitor well, piezometer P-14 will be converted to monitor well MW-57S and become part of the Chemical Manufacturing Plant groundwater monitoring network. Monitor wells MW-57S and MW-57D were relocated because of offsite access issues.

Please feel free to contact Mike Griffin, Sloss Industries, or myself at your convenience if you have any questions.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

Pedro Fierro, Jr.
Associate

Copies:
William G. Hardy, ADEM
Mike Griffin

Our ref.:
G:\proj\TF320\ltr\meri051000

TABLE 1
Phase II Chemical Manufacturing Plant and Coke Manufacturing Plant Groundwater and Soil Investigations
Sloss Industries Corporation

Proposed Well Number	Proposed Well Depth (ft bls)	Aquifer	Purpose of Monitor Well	Proposed Monitor Well Location - Where Proposed	Sampling Matrix	Proposed Analytes
Phase II Facility-Wide RFI Wells Proposed at Chemical Manufacturing Plant						
MW-50	Approx. 26	Shallow Conasauga	Evaluate horizontal extent of benzene contamination in the vicinity of P-13S and groundwater flow direction	Side gradient - Facility-Wide RFI	GW	VOCs, SVOCs, PP metals, barium, cyanide
MW-51	Approx. 26	Shallow Conasauga	Same as MW-50	Upgradient - Response to comments	GW	VOCs, SVOCs, PP metals, barium, cyanide
MW-52	Approx. 26	Shallow Conasauga	Same as MW-50	Downgradient or upgradient - Response to comments	GW, SL (top, middle, above bedrock)	VOCs, SVOCs, PP metals, barium, cyanide
MW-53	Approx. 26	Shallow Conasauga	Same as MW-50	Side gradient - Response to comments	GW, SL (top, middle, above bedrock)	VOC, SVOCs, PP metals, barium, cyanide
MW-57D	Approx. 169.5	Deep Conasauga	Assess the extent of the vinyl chloride contamination in the vicinity of P-13D	Adjacent to P-14 - April 12, 2000 meeting with EPA.	GW	VOC, SVOCs, PP metals, barium, cyanide
Phase II Chemical Manufacturing Plant RFI Proposed Monitor Wells						
MW-54	Approx. 26	Shallow Conasauga	Assess impact of soil on groundwater at SWMU 31	Sidegradient of Chemical Plant - Chemical Plant RFI	GW, SL (top, middle, above bedrock)	VOCs, SVOCs PP metals, barium, cyanide
MW-55	Approx. 26	Shallow Conasauga	Assess impact of soil on groundwater at SWMU 27	Near SWMU 27 - Chemical Plant RFI	GW, SL (top, middle, above bedrock)	VOCs, SVOCs, PP metals, barium, cyanide
MW-56	Approx. 26	Shallow Conasauga	Assess impact of soil on groundwater at SWMUs 29 and 26	Near SWMUs 26 and 29 - Chemical Plant RFI	GW, SL (top, middle, above bedrock)	VOCs, SVOCs, PP metals, barium, cyanide

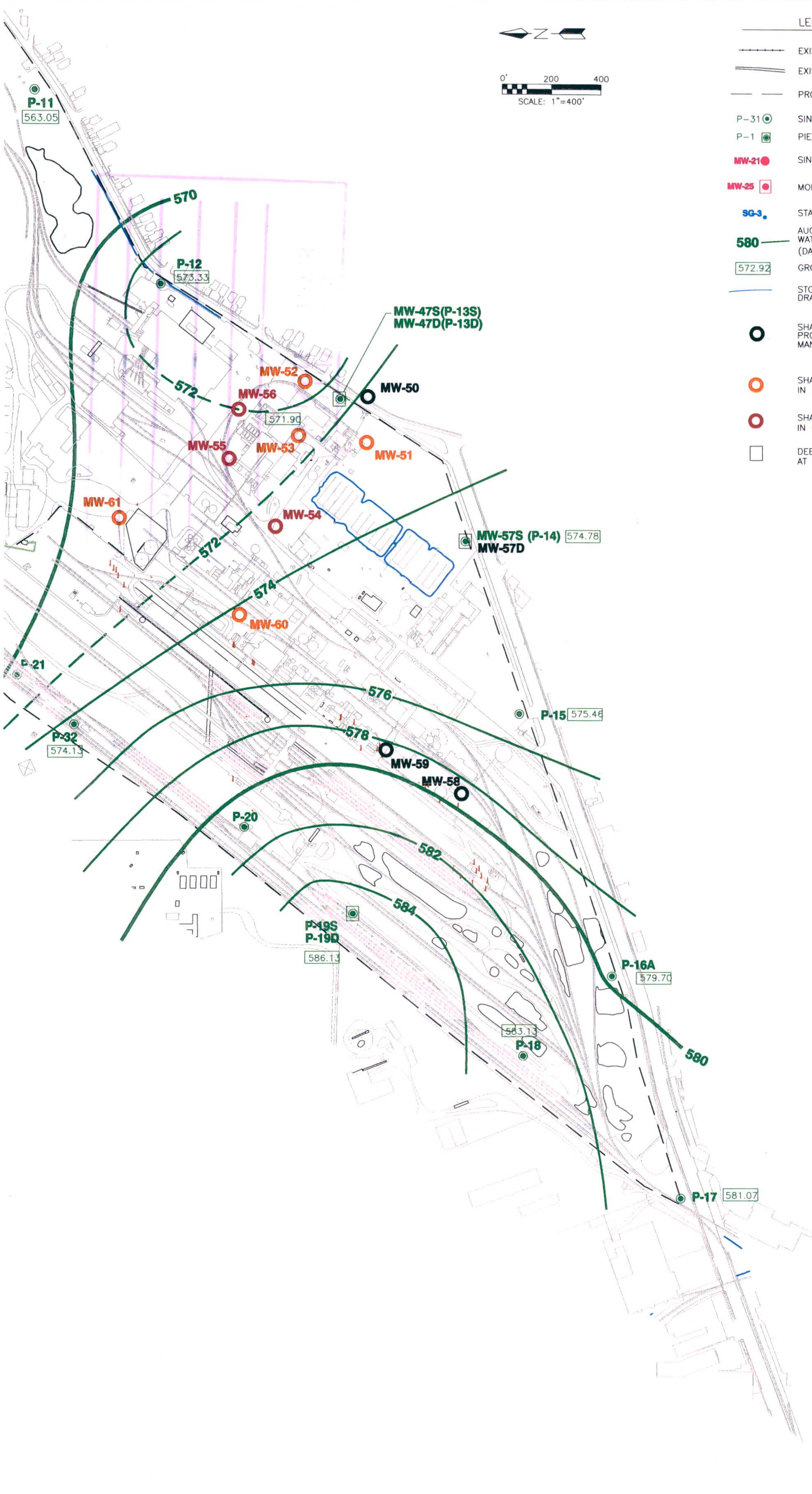
Footnotes on Page 2

TABLE 1
Phase II Chemical Manufacturing Plant and Coke Manufacturing Plant Groundwater and Soil Investigations
Sloss Industries Corporation

Proposed Well Number	Proposed Well Depth (ft bls)	Aquifer	Purpose of Monitor Well	Proposed Monitor Well Location - Where Proposed	Sampling Matrix	Proposed Analytes
Phase II Coke Manufacturing Plant Proposed Monitor Wells and Soil Borings						
MW-58	Approx. 25	Shallow Conasauga	Determine presence or absence of groundwater contamination at SWMU 5	In the vicinity of soil boring 960612-CO-05-SL0002 - Coke Plant RFI	GW	SVOCs
MW-59	Approx. 25	Shallow Conasauga	Determine presence or absence of groundwater contamination at SWMU 7	In the vicinity of soil boring 960615-CO-07-SL0001 - Coke Plant RFI	GW	SVOCs
MW-60	Approx. 25	Shallow Conasauga	Determine presence or absence of groundwater contamination at SWMUs 10 and 11	Downgradient of SWMUs 10 and 11 - Response to comments	GW	VOCs, SVOCs, PP metals, barium, cyanide
MW-61	Approx. 25	Shallow Conasauga	Determine presence or absence of groundwater contamination downgradient of Coke Plant	Downgradient of Coke Plant - Response to comments	GW	VOCs, SVOCs, PP metals, barium, cyanide
2 borings		Soil	Delineate soil contamination at SWMU 7	One southeast and one southwest of soil boring 960615-CO-7-SL0001 - Response to comments	SL (below structure, middle, above bedrock)	SVOCs

Note: Piezometers P-13S and P-13D will be renamed MW-49S and MW-49D, respectively, and piezometer P-14 will be renamed MW-57S and become part of the Chemical Manufacturing Plant groundwater monitoring network..
The Phase II Chemical Plant groundwater sampling includes monitor wells MW-49S (P-13S), MW-49D (P-13D), MW-50, MW-51, MW-52, MW-53, MW-54, MW-55, MW-56, MW-57S (P-14), MW-57D.
The Phase II Coke Manufacturing Plant groundwater sampling includes monitor wells MW-58, MW-59, MW-60, MW-61.
Additionally, water levels will be measured at all site piezometers and monitor wells.

NA - Not applicable.
VOCs - Volatile organic compounds.
SVOCs - Semivolatile organic compounds.
PP - Priority Pollutant.



LEGEND

EXISTING RAILROADS

EXISTING ROADS

PROPERTY BOUNDARY

P-31 SINGLE PIEZOMETERS

P-1 PIEZOMETER COUPLET

MW-21 SINGLE MONITOR WELL

MW-25 MONITOR WELL COUPLET

SG-3 STAFF GAGE

580 AUGUST 3, 1998 WATER TABLE ELEVATION CONTOUR(ft amsl) (DASHED LINES ARE INFERRED)

572.92 GROUNDWATER TABLE ELEVATION(ft amsl)

STORM WATER DRAINAGE DITCH

SHALLOW MONITOR WELL LOCATION PROPOSED IN FACILITY-WIDE, COKE MANUFACTURING PLANT AND RFI REPORTS

SHALLOW MONITOR WELL LOCATION PROPOSED IN RESPONSE TO COMMENTS

SHALLOW MONITOR WELL LOCATION PROPOSED IN CHEMICAL MANUFACTURING PLANT RFI REPORT

DEEP MONITOR WELL LOCATION PROPOSED AT APRIL 12, 2000 MEETING WITH EPA

ARCADIS GERAGHTY & MILLER
14497 North Dale Mabry Hwy., Suite 115
Tampa, Florida 33618
Tel: 813/961-1921 Fax: 813/961-2599

DATE 5/3/2000	PROJECT MANAGER PF	PROJECT OFFICER PF	
DRAWN BJH	LEAD DESIGN PROF. KT	CHECKED KT	
CADD FILE NAME SLPH2MW.DWG	PROJECT NUMBER TF000320.0016		

PROPOSED MONITOR WELL LOCATIONS FOR THE PHASE II COKE MANUFACTURING PLANT, FACILITY-WIDE, AND CHEMICAL MANUFACTURING PLANT INVESTIGATIONS

SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET S.W.
ATLANTA, GEORGIA 30303-8960

JUL 2 1 2000

4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Charles A. Jones
Director of Environmental Affairs
Sloss Industries Corporation
Post office Box 5327
3500 35th Avenue North
Birmingham, Alabama 33618

SUBJ: EPA Conditional Approval of the Land Disposal Areas Draft RCRA Facility Investigation (RFI) and Addendum Reports.
Sloss Industries Corporation (Sloss), Birmingham, Alabama.
Docket No. 89-39-R. EPA ID Number ALD 000 828 848

Dear Mr. Jones:

The United States Environmental Protection Agency Region 4 (EPA) has reviewed the subject documents, part of the Draft RFI reports, prepared by ARCADIS Geraghty & Miller, Inc. on behalf of Sloss Industries Corporation.

Based upon EPA's review, the aforementioned reports are conditionally approved contingent upon Sloss addressing the enclosed comments and submitting a revised Land Disposal Areas RFI Report that reflects such comments.

Within thirty (30) calendar days of receipt of this letter, Sloss shall submit to EPA and the Alabama Department of Environmental Management (ADEM), the revised RFI Report.

Please note that one (1) copy of the revised RFI report shall be sent to the Region 4 Project Coordinator at the following address:

Carlos E. Merizalde
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch
Waste Management Division
U.S. EPA, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

Also, one (1) copy of all RFI documents shall be sent to ADEM's Hazardous Waste Branch at the following address:

William G. Hardy, Director
Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

Should you have any questions, please contact Mr. Carlos E. Merizalde, of my staff, at (404) 562-8606.

Sincerely,

Jeffrey T. Pallas, Chief
RCRA South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch

Enclosure

cc w/encl.: William G. Hardy, ADEM

Sloss Industries Corporation
Birmingham, Alabama
EPA ID Number ALD 000 828 848

Response to Land Disposal Areas Draft RFI 1st NOTI and Addendum Reports

Comment 1: Risk Assessment - Response 11 (page 21). Part of Section 5.6.1, page 5-25, Sources of Uncertainty. EPA maintains that site-specific data (as opposed to literature references) are needed to support the claim that "natural attenuation processes are expected to substantially reduce constituent concentrations over time." This statement must be omitted, or at least severely modified, until site-specific data are obtained to demonstrate that this process is occurring at this site.

Comment 2: Risk Assessment and Hydrogeology - Response to General Comment 2 (page 22). "Groundwater exposure is not evaluated in this risk assessment because it is not used as a potable water supply at the site or in the surrounding area" (Land Disposal Areas Report, page 5-18). This statement cannot be accepted at this time because the extent of groundwater contamination has not been defined. Please delete this statement or alter it accordingly, so that it reflects your response in page 23, last paragraph: "The extent of groundwater contamination will be characterized."

A major issue to address is the potential future use of the groundwater. This RFI report assumes that the groundwater is not used as a drinking water source (now or ever), and therefore only considers incidental contact of a worker with the groundwater during excavation (Minimal exposure compared to drinking and bathing with this water). It is a critical policy issue to determine if the affected groundwater should be assessed as a potential drinking water source (apparently none of the groundwater affected by the facility has yet been assessed as a drinking water source). EPA generally considers groundwater as a resource that should be protected/restored for its maximum beneficial use (e.g., drinking water) unless some reason not related to the site contamination (e.g., low yield, salinity) precludes this use.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET S.W.
ATLANTA, GEORGIA 30303-8960

JUL 27 2000

4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Charles A. Jones
Director of Environmental Affairs
Sloss Industries Corporation
Post office Box 5327
3500 35th Avenue North
Birmingham, Alabama 33618

SUBJ: Comments on BTF and Sewers Draft RCRA Facility Investigation (RFI) and Addendum Reports for Sloss Industries Corporation (Sloss), Birmingham, Alabama. First Notice of Technical Inadequacy.
Docket No. 89-39-R. EPA ID Number ALD 000 828 848

Dear Mr. Jones:

The United States Environmental Protection Agency Region 4 (EPA) has reviewed the subject documents, part of the Draft RFI reports, prepared by ARCADIS Geraghty & Miller, Inc. on behalf of Sloss Industries Corporation.

Based upon EPA's review, the aforementioned reports are considered technically inadequate. Enclosed are specific comments from EPA detailing the reports inadequacies. For Sloss's convenience, EPA comments are referenced, where appropriate, to specific parts and/or pages of the originally submitted Draft RFI Reports.

Within forty-five (45) calendar days of receipt of this letter, Sloss shall submit to EPA and the Alabama Department of Environmental Management (ADEM), a revised RFI Report that addresses the enclosed comments.

Please note that three (3) copies of all RFI documents submitted shall be sent to the Region 4 Project Coordinator at the following address:

Carlos E. Merizalde
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch
Waste Management Division
U.S. EPA, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

Also, one (1) copy of all RFI documents shall be sent to ADEM's Hazardous Waste Branch at the following address:

William G. Hardy, Director
Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

Please note that submittal and approval of this RFI report is part of the requirements of Section 3008(h) of RCRA, 42 U.S.C. § 6928(h), Administrative Order (Order), issued to Sloss on September 29, 1989, docket number 89-39-R. Pursuant to Section XIV of the Order, the failure or refusal to carry out the terms of the Order in a manner deemed satisfactory subjects Sloss to a civil penalty in an amount not to exceed $25,000 for each day of noncompliance with the Order in accordance with Section 3008(h) of RCRA, 42 U.S.C. § 6928(h).

Should you have any questions, please contact Mr. Carlos E. Merizalde, of my staff, at (404) 562-8606.

Sincerely,

Jeffrey T. Pallas, Chief
RCRA South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch

Enclosure

cc w/encl.: ✓ William G. Hardy, ADEM

Sloss Industries Corporation
Birmingham, Alabama
EPA ID Number ALD 000 828 848

RISK ASSESSMENT COMMENTS
BTF and Sewers Draft RFI and Addendum Reports

GENERAL COMMENTS

Comment 1: For the Addendum Report: EPA does not concur with the conclusion regarding "No further action" on page 24. The risks must be adequately assessed before any conclusions can be made regarding the need for further action. Please revise the text of the report accordingly.

Comment 2: The use of sampling techniques and procedures appear to be compatible to those used in EPA Region 4, and outlined in the Environmental Investigations Standard Operating Procedures & Quality Assurance Manual (EISOPQAM), May 1996. Please include a statement, where appropriate, that sampling techniques followed EPA's SOP or identify where and why deviations were used.

Comment 3: A major issue to address is the potential future use of the groundwater. This RFI report assumes that the groundwater is not used as a drinking water source (now or ever), and therefore only considers incidental contact of a worker with the groundwater during excavation (Minimal exposure compared to drinking and bathing with this water). It is a critical policy issue to determine if the affected groundwater should be assessed as a potential drinking water source (apparently none of the groundwater affected by the facility has yet been assessed as a drinking water source). EPA generally considers groundwater as a resource that should be protected/restored for its maximum beneficial use (e.g., drinking water) unless some reason not related to the site contamination (e.g., low yield, salinity) precludes this use. Several of the chemical concentrations reported on tables G-5, G-6 exceed their MCLs and/or health-based levels.

Comment 4: Surface soil has not been included in the risk assessment (Section 5.1, pg 105). Also no human exposure to the surface water and sediment in the drainage ditches is assessed. Please add these exposure media to the assessment or provide a justification for not doing so.

Comment 5: Page 105, exposure scenarios/receptors. Please include a trespasser scenario (i.e., site visitor other than worker) or provide a justification for not doing so.

SPECIFIC COMMENTS

Comment 1: Pages 106, G-24, G-25. The approach of assuming "that one site worker is simultaneously exposed to...2 different SWMUs...which is not possible" is not supportable, and it only serves to draw undue criticism to the risk assessment process for being not just overly conservative, but unrealistic. The screening process (at the beginning of the risk assessment) is meant to compare site concentrations to conservative screening values. Please assess for risk chemicals that are not screened out using exposure scenarios (current and future) that are realistic for each receptor.

Comment 2: Tables G-2, G-4, G-5, G-7, G-8, G-13, G-16, and risk tables in Appendix G - screening and assessment of sulfide. Groundwater results report sulfide at concentrations ranging from 0.4 - 16.0 mg/L. The EPA RBC table has a screening value for hydrogen sulfide in water of 0.11 mg/L (would be 0.011 for HQ=0.1). This value is based on an oral RfD of 3E-3 mg/kg-d. The corresponding value for sulfide in residential surface soil would be 230 mg/kg (23 at HQ=0.1). Adjustment of these values to account for the sulfide component of the hydrogen sulfide molecule does not change the RfD (or resultant RBC) as the hydrogen atoms are such a small fraction, in terms of mass, of the molecule. It should be noted that even though this is an EPA-verified (IRIS) value, the accompanying text in IRIS discloses the low confidence in this value. These RBC and RfD values should be used to screen and assess sulfide. The text of the risk assessment report (especially the uncertainty and conclusions sections) must discuss the uncertainty of assessing risks from sulfide due to EPA's low confidence in the sulfide toxicity value. If an unacceptable risk results from sulfide, the range of uncertainty about the toxicity value should be brought to light, and EPA must be consulted regarding an appropriate remedial level.

Comment 3: Table G-13, toxicity values, under the chronic column. Please correct the following values in this table:

The current oral reference dose (RfD) for naphthalene is 2E-2 mg/kg-d (IRIS).

The RfD for mercuric chloride [3E-4 mg/kg-d (IRIS)] should used to assess oral exposure to mercury in all abiotic media.

EPA has a provisional oral RfD for benzene of 3E-3 mg/kg-d. (EPA-PROV)

EPA has a provisional oral RfD for dibenzofuran of 4E-3 mg/kg-d. (EPA-PROV)

Comment 4: Table G-15, dermal exposure.

The permeability coefficient (PC) values for the inorganics are said to be "assumed". On what is this assumption based? Please explain.

The dermal absorption efficiency of cyanide is said to be "assumed." On what is this assumption based? Please explain.

The oral absorption efficiency of bis(2-ethylhexyl)phthalate is said to be based on "Region IV Default Values." The regional default value for this class of compounds (semivolatiles) is 0.5 (i.e., 50%) which is not in agreement with the value in this table. Please revise the table.

The dermal absorption efficiencies of arsenic, barium, and chromium reference the Region 4 Supplemental guidance. This guidance document gives a default value for dermal absorption of 0.001 (i.e., 0.1%) for inorganics (EPA 1995) which is not in agreement with the value in this table. Please revise the table.

Comment 5: Table G-20, pg 4 of 4, HI from benzene in air. The resultant HI appears to be 10-fold too high. Please recheck calculations.

Comment 6: Table G-17; Section 5.3, pgs G-18, G-19, G-20 - sludge excavation worker. What is the justification for assuming 50 mg/d as an incidental ingestion rate for this worker? (480 mg/d was assumed for the subsurface excavation worker.) Usually 50 mg/d is appropriate to assume for a worker who does not have intense contact with the soil (e.g., office worker, warehouse worker). The ingestion rate for this sludge excavation worker should be increased unless justification is provided for not doing so (i.e., this is not a contact intensive activity in comparison to the subsurface excavation worker). An explanation should be given for whatever ingestion rate is used here.

REFERENCES:

EPA (1995). Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins. EPA Region 4, November 1995.

EPA (1989). Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual, Part A. Interim Final, EPA OERR, December 1989.

IRIS, 1999. Integrated Risk and Information System, National Center for Environmental Assessment, Office of Research & Development, USEPA, 1999 (website [www.epa.gov/iris], updates added periodically).

HEAST, 1997. Health Effects Assessment Summary Tables, FY 1997 Update, Office of Solid Waste and Emergency Response, USEPA, July 1997.

EPA-PROV. EPA provisional toxicity values support document available on request from Office of Technical Services, EPA Region 4.

HYDROGEOLOGY COMMENTS
BTF and Sewers Draft RFI Report

GENERAL COMMENT

The potential for off-site migration is not addressed in the BTF and Sewers report. A situation is presented in the BTF & Sewers report at SWMU37 where monitoring wells P21, P22 and P32 are described on page 75 as "nearby" and "in the vicinity", but are actually 500 and 700 feet away, too far to be effective down gradient monitoring wells.

Benzene concentrations in MW17 near SWMU22 also exceed the MCL for benzene. MW17 is located near the down gradient boundary of the Sloss property and contaminated groundwater from the SWMU22 area probably leaves the Sloss property. There are no monitoring wells down gradient from the site. There are no monitoring wells beyond Five Mile Creek to show relationships between the site, the creek and the rock quarries in the area. The shape of the 400 foot water level contour on Figure 2-11 suggests that groundwater leaves the site between MW5D and P10, but there are no monitoring wells in this 3,200 foot long portion of the property boundary. The spacing between monitoring wells in the shallow aquifer in the BTF & Sewers area probably averages 400 feet along the property boundary (Figure 2-10). The spacing between monitoring wells in the deep aquifer is much greater (Figure 2-11) and few of the deep wells are located down gradient from specific SWMUs.

Contaminated groundwater is present, but no groundwater plumes have been identified. Groundwater velocities as high as 9,000 ft/year are reported (BTF and Sewers report, p. 82). Contaminant retardation in the fractures of the Conasauga Limestone is likely to be negligible, so movement rates of dissolved contaminants are likely to be similar to groundwater movement rates. Matrix diffusion will be negligible. No evidence supporting natural attenuation is presented. No evaluation of the extent of off-site contamination has occurred. The extent of groundwater contamination has not been defined at SWMUs in the BTF and Sewers area.

The situation for contaminated soil is similar. The extent of contaminated soils have not been defined on any of the maps in the BTF and Sewers report. Volumes of contaminated soil are not estimated in the BTF & Sewers report, so basic site characterization factors typically included in a RFI report have not been prepared for the Corrective Measures Study investigations.

SPECIFIC COMMENTS

Comment 1: The concentration of benzene in groundwater from MW17 exceeds the MCL (page 91) for benzene by a factor of 3 (Table 4-19). There are no other wells nearby. The benzene concentration may not be from the center of the plume, therefore higher benzene concentrations may be present in groundwater leaving the site. MW17 is located at the edge of the Sloss property. Figure 2-10 shows that groundwater flow directions from MW17 are northward, therefore groundwater contaminated with benzene in excess of the MCL is moving north-eastward, off site. None of the figures in the report show the extent of groundwater contamination in the vicinity of SWMU22. The extent of groundwater contamination has not been defined.

Comment 2: Please clarify the number of monitoring wells which were sampled. The text at the beginning of section 3.9.1, page 43 states "A total of twenty (17) wells ... " were sampled.

Comment 3: The presence of DNAPL in MW3 and MW4A, coupled with the low pH of the influent and effluent at SWMU13 (BTF and Sewers, p. 16, locations on Figure 2-12) suggests the potential for deep contaminant migration in the limestone aquifer. The secondary porosity of the Conasauga Formation limestones underlying the SWMU13 area may have been enhanced and contaminant migration from the site may be more rapid than in other areas. The extent of NAPL contamination, rates of contaminant migration and degradation should be determined. Natural or man-made discharge areas and potential receptors should be identified, which can not be done until the extent of contamination has been defined.

Comment 4: Section 4.1 is titled "BTF Equalization Basin and BTF Emergency Basin (SWMUs 13 and 21)". Most of the paragraphs in this section refer to "SWMUs 13 and 21", but there are two references to "SWMUs 13 and 22" on page 63. SWMU 22 isn't very far away, but probably wasn't meant to be included in this section. Please verify whether the references to SWMU 22 in Section 4.1 are typographical errors and make corrections if necessary.

BTF and Sewers Draft RFI Addendum Report

GENERAL COMMENT

The description of procedures used to purge the monitoring wells prior (page 10) to sampling indicates that low flow purging procedures are not being used. Purge pumps are lowered in the well as water levels decline (page 10). The amount of which the pump may be lowered is not specified, but the text states that some wells are pumped until dry. The EPA Region 4 SOP specifically recommends that wells should not be pumped until dry when purging. Some purge rates presented in Appendix A exceed 2.6 liters/minute, which greatly exceeds rates recommended for low-flow purging.

When the discharge rate exceeds the well yield, the increased hydraulic gradient between the formation and the well can mobilize particles, elevating turbidity. Continued removal of water can dewater the filter pack, leading to gravity drainage of pore water and sediments, further increasing turbidity. Table 3-3 shows that 5/7 turbidity values reported in this report exceeded the Region 4 SOP recommendation for a maximum turbidity of 10NTU in groundwater samples. One of the samples which didn't exceed this recommendation had a turbidity of 9.4 NTU.

Over-pumping during purging can result in loss of volatile compounds from the water and false positive results for metals. Samples which include metals sorbed on normally immobile matrix particles may bias analytical results if suspended particle concentrations are very high, leading to elevated concentrations of contaminants. This is known to be particularly applicable to metals, but may apply to other contaminants, such as PAHs and pesticides. In general, the purging process should not lower the water level in the well more than a few tenths of feet. Low flow purge rates between 0.1 and 0.3 liters/minute can be achieved with peristaltic or bladder pumps. The depths to water shown on Table 3-1 indicate that peristaltic pumps could be used at many of the wells at this site. Bladder pumps probably could be used at the deeper wells. Regardless of the type of pump used, "... the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen" (EPA, 1996, Section V).

Low flow procedures should be adapted for future sampling events where possible. The text refers to methods for collecting VOCs which are described in the QAAP. However, if a bailer is being used, VOCs can be collected from purged wells using the tube & glove method (EPA Region 4 SOP Section 7.3.3), rather than a bailer. Samples for metals should not be collected until a reasonable effort is made to reduce the turbidity to less than 10NTUs. EPA Region 4 has achieved this goal in temporary (direct push) wells using peristaltic pumps powered by motorcycle batteries. Purging times may be as long as a few hours, however, a single operator with multiple pumps and batteries can purge numerous wells simultaneously, producing less water for disposal and assuring better quality samples. The cost for a "reasonable effort to reduce turbidity below 10 NTU" must be weighed against the cost of subsequent meetings and reports arguing that high metals concentrations are false positive results which may be the result of turbid samples.

SPECIFIC COMMENTS

Comment 1: Figures 4-4 and 4-7 show that in the vicinity where DNAPL has been observed near MW4A, the first MW10 borehole and MW3, a trough in the bedrock surface generally coincides with the course of a "Pre-RCRA stream" which used to drain the area. Figure 4-4 shows that the DNAPL at MW4A is on a bedrock high. Does DNAPL from the vicinity of MW4A move down the bedrock surface toward the bedrock trough? Does the old stream channel influence groundwater flow directions and contaminant pathways? Please explain.

Comment 2: Figure 4-5 shows shallow groundwater contours crossing the ditch on the east side of the site. The interpretation shows that the ditch was not the discharge area for shallow groundwater in this area, and does show that groundwater from the vicinity of SWMU13 leaves Sloss property and crosses the railroad tracks.

Elevations from the U.S.G.S. Birmingham North topographic map suggest that the groundwater flow directions near SWMU13 may not be correct. The ditch drains toward the north, yet the groundwater contours show that groundwater between MW5 and MW12 flows across the ditch to the southeast. Are the ditches connected to the shallow groundwater flow system? Could buried stream beds, ditches or storm drains be diverting shallow groundwater from the SWMU13 area. What is the water level in the equalization basin (SWMU13)? SWMU13 has a clay liner and therefore leakage from the pond may create a mound on the water table. Does the basin or the surface water drainages south of the basin affect groundwater flow directions? The presence of LNAPL and DNAPL in this area (Figure 4-6), make interpretation of groundwater flow directions (Figure 4-5), the bedrock topography (Figure 4-4), and the relationships between surface water drainage and the equalization pond critical. Is there any evidence for the existence of an unsaturated zone beneath the pond?

Figure 4.5 shows that groundwater contamination from the LNAPL at MW6 would have to be 30 feet wide in the vicinity of MW42 for the edge of the plume to be detected at MW42. If it can be shown that surface water drainages influence groundwater flow directions, a plume might be better defined using the surface water data combined with water level elevations. If additional wells are necessary to define the plume, the location selection process should consider surface water as potential groundwater discharge areas.

Please re-evaluate the water level contours presented on Figure 4-5 considering the effects of surface water discharge areas and the potential for mounding of the water table beneath SWMU13.

REFERENCES:

EPA, 1994a, Project Summary, Evaluation of Sampling and Field-Filtration Methods for the Analysis of Trace Metals in Ground Water, Pohlmann, K.F. , G.A., Icopini, R.D. McArthur, and C.G. Rosal, Environmental Protection Systems Laboratory, Environmental Protection Agency Las Vegas, NV 89193-3478, Research and Development EPA/600/SR-94/119 September 1994

EPA, 1994b, Evaluation of Sampling and Field-Filtration Methods for the Analysis of Trace Metals in Ground Water, Pohlmann, K.F. , G.A., Icopini, R.D. McArthur, and C.G. Rosal, Environmental Protection Systems Laboratory, Environmental Protection Agency Las Vegas, NV 89193-3478, Research and Development EPA/600/R-94/119 September 1994

EPA, 1996, Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures, United States Environmental Protection Agency, Office of Research and Development, Office of Solid Waste and Emergency Response, EPA/540/S-95/504, December 1995, April, 1996. (http://www.micropurge.com/EPApuls.html ,R.W. Puls and M.J. Barcelona)

EPA Region 4, 1996, Science and Ecosystem Support Division, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996 (EISOPQAM).

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET S.W.
ATLANTA, GEORGIA 30303-8960

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LAND DIVISION

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4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Charles A. Jones
Director of Environmental Affairs
Sloss Industries Corporation
Post office Box 5327
3500 35th Avenue North
Birmingham, Alabama 33618

SUBJ: EPA Approval of the Facility-Wide, Coke Manufacturing Plant Draft RCRA Facility Investigation (RFI) and Addendum Reports.
Sloss Industries Corporation (Sloss), Birmingham, Alabama.
Docket No. 89-39-R. EPA ID Number ALD 000 828 848

Dear Mr. Jones:

The United States Environmental Protection Agency Region 4 (EPA) has reviewed the subject documents, part of the Draft RFI reports, prepared by ARCADIS Geraghty & Miller, Inc. on behalf of Sloss Industries Corporation.

The objective of the Facility-Wide investigation was to develop a site specific understanding of the hydrogeologic and hydrologic setting of the Sloss facility and the nearby areas. In light of this and based on EPA's review of the subject Facility-Wide Draft RFI report, EPA is hereby approving such report. EPA agrees with Sloss's proposal to place a copy of the approved final report in the local repository.

Also, based upon EPA's review, the aforementioned Coke Manufacturing Plant and Addendum Reports are conditionally approved contingent upon Sloss addressing the enclosed comments and submitting a revised Coke Manufacturing Plant RFI Report that reflects such comments.

Within thirty (30) calendar days of receipt of this letter, Sloss shall submit to EPA and the Alabama Department of Environmental Management (ADEM), the revised RFI Reports.

Please note that one (1) copy of the revised RFI reports shall be sent to the Region 4 Project Coordinator at the following address:

Carlos E. Merizalde
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch
Waste Management Division
U.S. EPA, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303

Also, one (1) copy of all RFI documents shall be sent to ADEM's Hazardous Waste Branch at the following address:

William G. Hardy, Director
Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

Should you have any questions, please contact Mr. Carlos E. Merizalde, of my staff, at (404) 562-8606.

Sincerely,

E. Burk for

Jeffrey T. Pallas, Chief
RCRA South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch

Enclosure

cc w/encl.: William G. Hardy, ADEM

Response to Coke Manufacturing Plant Draft RFI 1st NOTI and Addendum Reports

Comment 1: Risk Assessment - Response 19 (page 9). Part of Section 5.6.1, page 5-21, Sources of Uncertainty. EPA maintains that site-specific data (as opposed to literature references) are needed to support the claim that "natural attenuation processes are expected to substantially reduce constituent concentrations over time." This statement must be omitted, or at least severely modified, until site-specific data are obtained to demonstrate that this process is occurring at this site.

Comment 2: Risk Assessment and Hydrogeology - Response to General Comment 2.2 (page 12 3rd paragraph). "Groundwater was not sampled as part of the Coke Plant RFI and is not considered to be an exposure point. There are no water-supply wells within the vicinity of the site. The residential area located next to the facility is on a municipal water supply; therefore, it is highly unlikely that the shallow groundwater would ever be used as a water supply in the future near the site. Therefore, groundwater is not considered an exposure pathway of concern for the Coke Manufacturing Plant." (Coke Plant Report p. 5-15). The statement that groundwater is not an exposure point can not be accepted at this time because the extent of groundwater contamination has not been defined. Please delete this statement or alter it accordingly.

A major issue to address is the potential future use of the groundwater. This RFI report assumes that the groundwater is not used as a drinking water source (now or ever), and therefore only considers incidental contact of a worker with the groundwater during excavation (Minimal exposure compared to drinking and bathing with this water). It is a critical policy issue to determine if the affected groundwater should be assessed as a potential drinking water source (apparently none of the groundwater affected by the facility has yet been assessed as a drinking water source). EPA generally considers groundwater as a resource that should be protected/restored for its maximum beneficial use (e.g., drinking water) unless some reason not related to the site contamination (e.g., low yield, salinity) precludes this use.

FILE COPY

ARCADIS GERAGHTY & MILLER

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ENVIRONMENTAL

Mr. Carlos E. Merizalde
South Enforcement and Compliance Section
RCRA Enforcement and Compliance Branch
Waste Management Division
U.S. EPA, Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

Subject:
Response to Comments on BTF and Sewers Draft RCRA Facility Investigation (RFI) and Addendum Reports
Sloss Industries Corporation, Birmingham, Alabama
Docket No. 80-39-R; EPA ID No. ALD 000 828 848
ARCADIS Geraghty & Miller Project No. TF000320.0016

Tampa, Florida
23 October 2000

Contact:
Pedro Fierro

Extension:
813.264.3453

Dear Mr. Merizalde:

Attached are the responses to the July 27, 2000 comments on the BTF and Sewers Draft RCRA Facility Investigation (RFI) and Addendum reports for the Sloss Industries Corporation (Sloss), Birmingham, Alabama. If you have any questions, please contact me at 813-264-3453.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

Pedro Fierro, Jr., P.G.
Associate

Enclosure

Copies:
Mr. William G. Hardy, Alabama Department of Environmental Management
Mr. Mike Griffin, Sloss Industries Corporation

RISK ASSESSMENT COMMENTS
BTF and Sewers Draft RFI and Addendum Reports

GENERAL COMMENTS

Comment 1:

For the Addendum Report: EPA does not concur with the conclusion regarding "No further action" on page 24. The risks must be adequately assessed before any conclusions can be made regarding the need for further action. Please revise the text of the report accordingly.

Response:

The text will be revised to reflect the conclusions of the revised risk assessment.

Comment 2:

The use of sampling techniques and procedures appear to be compatible to those used in EPA Region 4, and outlined in the Environmental Investigations Standard Operating Procedures & Quality Assurance Manual (EISOPQAM), May 1996. Please include a statement, where appropriate, that sampling techniques followed EPA's SOP or identify where and why deviations were used.

Response:

The RFI Work Plan indicates in Section 4.0, Sampling Procedures (Page 1) of the Quality Assurance Project Plan that "Sampling of groundwater, surface water, soil/sediment, and solid wastes will be carried out in accordance with protocols described in Section 4 of the EPA Region IV SOP/QAM." A statement will be included, where appropriate, indicating that sampling techniques followed EPA's SOP. Any deviations will be identified.

Comment 3:

A major issue to address is the potential future use of the groundwater. This RFI report assumes that the groundwater is not used as a drinking water source (now or ever), and therefore only considers incidental contact of a worker with the groundwater during excavation (Minimal exposure compared to drinking and bathing with this water). It is a critical policy issue to determine if the affected groundwater should be assessed as a potential drinking water source (apparently none of the groundwater affected by the facility has yet been assessed as a drinking water source). EPA generally considers groundwater as a resource that should be protected/restored for its maximum beneficial use (e.g., drinking water) unless some reason not related to the site contamination (e.g., low yield, salinity) precludes this use. Several of the chemical concentrations reported on tables G-5, G-6 exceed their MCLs and/or health-based levels.

Response:

Groundwater data are available for SWMU 22 and SWMUs 13 and 21 combined. These data will be used to evaluate potential exposure to groundwater when used as a potable water supply in the revised risk assessment.

Comment 4:

Surface soil has not been included in the risk assessment (Section 5.1, page 105). Also no human exposure to the surface water and sediment in the drainage ditches is assessed. Please add these exposure media to the assessment or provide a justification for not doing so.

Response:

Following the USEPA approved RFI Work Plan, surface soil data were not collected for this area of the facility. Human exposure to surface water and sediment in the drainage ditches was not evaluated previously because access to these media is limited. However, exposure of an older child and adult to surface water and sediment in the drainage ditches will be added during the revisions to the document.

Comment 5:

Page 105, exposure scenarios/receptors. Please include a trespasser scenario (i.e., site visitor other than worker) or provide a justification for not doing so.

Response:

While access to this area of the site is difficult, exposure of a trespasser will be included in the revised human health risk assessment. In looking at this area of the facility, the only point of exposure is likely to be the drainage ditches. Therefore, the trespasser exposures will be those identified in the Response to Comment 4.

SPECIFIC COMMENTS

Comment 1:

Pages 106, G-24, G-25. The approach of assuming "that one site worker is simultaneously exposed to...2 different SWMUs...which is not possible" is not supportable, and it only serves to draw undue criticism to the risk assessment process for being not just overly conservative, but unrealistic. The screening process (at the beginning of the risk assessment) is meant to compare site concentrations to conservative screening values. Please assess for risk chemicals that are not screened out using exposure scenarios (current and future) that are realistic for each receptor.

Response:

The sentence in question was in reference to the calculation of a total site risk for the worker. Worker exposure was based on an 8 hour per day exposure at an individual SWMU. If the four risks were added together, the worker would be assumed to be present at the site 24 hours per day. This is unrealistic. However, the sentence will be revised in the risk assessment to indicate that total site risks were calculated by receptor.

Comment 2:

Tables G-2, G-4, G-5, G-7, G-8, G-13, G-16, and risk tables in Appendix G – screening and assessment of sulfide. Groundwater results report sulfide at concentrations ranging from 0.4 – 16.0 mg/L. The EPA RBC table has a screening value for hydrogen sulfide in water of 0.11 mg/L (would be 0.011 for HQ=0.1). This value is based on an oral RfD of 3E-3 mg/kg-d. The corresponding value for sulfide in residential surface soil would be 230 mg/kg (23 at HQ=0.1). Adjustment of these values to account for the sulfide component of the hydrogen sulfide molecule does not change the RfD (or resultant RBC) as the hydrogen atoms are such a small fraction, in terms of mass, of the molecule. It should be noted that even though this is an EPA-verified (IRIS) value, the accompanying text in IRIS discloses the low confidence in this value. These RBC and RfD values should be used to screen and assess sulfide. The text of the risk assessment report (especially the uncertainty and conclusions sections) must discuss the uncertainty of assessing the risks from sulfide due to EPA's low confidence in the sulfide toxicity value. If an unacceptable risk results from sulfide, the range of uncertainty about the toxicity value should be brought to light, and EPA must be consulted regarding an appropriate remedial level.

Response:

The toxicity value for hydrogen sulfide will be used to evaluate potential exposure to sulfide.

Comment 3:

Table G-13, toxicity values, under the chronic column. Please correct the following values in this table:

The current oral reference dose (RfD) for naphthalene is 2E-2 mg/kg-d (IRIS).

The RfD for mercuric chloride [3E-4 mg/kg-d (IRIS)] should be used to assess oral exposure to mercury in all abiotic media.

EPA has a provisional oral RfD for benzene of 3E-3 mg/kg-d (EPA-PROV).

EPA has a provisional oral RfD for dibenzofuran of 4E-3 mg/kg-d (EPA-PROV).

Response:

Current toxicity values will be used in the revised risk assessment.

Comment 4:

Table G-15, dermal exposure.

The permeability coefficient (PC) values for the inorganics are said to be "assumed". On what is this assumption based? Please explain.

The dermal absorption efficiency of cyanide is said to be "assumed." On what is this assumption based? Please explain.

The oral absorption efficiency of bis(2-ethylhexyl)phthalate is said to be based on "Region IV Default Values." The regional default value for this class of compounds (semivolatiles) is 0.5 (i.e., 50%) which is not in agreement with the value in this table. Please revise the table.

The dermal absorption efficiencies of arsenic, barium, and chromium reference the Region 4 Supplemental guidance. This guidance document gives a default value for dermal absorption of 0.001 (i.e., 0.1%) for inorganics (EPA 1995) which is not in agreement with the value in this table. Please revise the table.

Response:

The text will be revised to reflect the USEPA Region 4 guidance or the 1999 dermal guidance and documentation will be provided as to the source of the values used in the revised risk assessment.

Comment 5:

Table G-20, pg 4 of 4, HI from benzene in air. The resultant HI appears to be 10-fold too high. Please recheck calculations.

Response:

The calculations will be rechecked.

Comment 6:

Table G-17; Section 5.3, pgs G-18, G-19, G-20 – sludge excavation worker. What is the justification for assuming 50 mg/d as an incidental ingestion rate for this worker? (480 mg/d was assumed for the subsurface excavation worker). Usually 50 mg/d is appropriate to assume for a worker who does not have intense contact with the soil (e.g., office worker, warehouse worker). The ingestion rate for this sludge excavation worker should be increased unless justification is provided for not doing so (i.e., this is not a contact intensive activity in comparison to the subsurface excavation worker). An explanation should be given for whatever ingestion rate is used here.

Response:

The lower soil ingestion rate was used for the sludge exposure because the sludge was assumed to be moist and therefore ingestion of soil likely would be lower than for the excavation worker exposed to soil. This explanation will be included in the revised risk assessment report and the higher ingestion rate will not be used in the revised risk assessment.

HYDROGEOLOGY COMMENTS
BTF and Sewers Draft RFI Report

GENERAL COMMENT

Comment/Response:

The potential for off-site migration is not addressed in the BTF and Sewers report. A situation is presented in the BTF & Sewers report at SWMU37 where monitoring wells P21, P22 and P32 are described on page 75 as "nearby" and "in the vicinity", but are actually 500 and 700 feet away, too far to be effective down gradient monitoring wells.

The lithologic and hyrdogeologic data from P-21, P-22, and P-23 were used in the site specific geology and hydrogeology discussions for SWMU 37 because they were the closest monitor wells to this SWMU. Otherwise these sections would have been omitted. It was not Sloss's intention to use these piezometers as downgradient wells for SWMU 37. In the BTF and Sewers RFI Report recommendations (Section 6.3, page 109), Sloss proposed installing a monitor well downgradient of SWMU 37 to evaluate the groundwater at SWMU 37.

Benzene concentrations in MW17 near SWMU22 also exceed the MCL for benzene. MW17 is located near the down gradient boundary of the Sloss property and contaminated groundwater from the SWMU22 area probably leaves the Sloss property. There are no monitoring wells down gradient from the site.

Sloss proposes to install a shallow monitor well downgradient of MW-17 on the east side of the drainage ditch to delineate the horizontal extent of benzene contamination (Figure 6-1). The proposed monitor well location is approximate and will be finalized pending negotiation of access agreements with off site property owners and field evaluation of site access since woods and railroad tracks are located east of the drainage ditch.

There are no monitoring wells beyond Five Mile Creek to show relationships between the site, the creek and the rock quarries in the area.

Five Mile Creek is a regional hydrologic barrier for the shallow aquifer at the Sloss Facility acting as a discharge or recharge barrier depending on the time of the year. Therefore, Five Mile Creek will impede the

migration of groundwater contamination offsite. Since the rock quarries are located on the south side of Five Mile Creek, where Sloss is located, installation of additional monitor wells north of Five Mile Creek will not provide additional information on the relationship between the site and the quarries. Therefore, installation of a monitor well on the north side of Five Mile Creek is not warranted.

The shape of the 400 foot water level contour on Figure 2-11 suggests that groundwater leaves the site between MW5D and P10, but there are no monitoring wells in this 3,200 foot long portion of the property boundary.

Monitor wells were not installed between MW-5D and P-10 because this property is part of the LaFarge Quarry and is not owned by Sloss. Sloss has asked LaFarge for groundwater data collected from monitor wells located adjacent to the quarry; however, LaFarge was not interested in sharing the information. Sloss has installed several monitoring wells along the Sloss/LaFarge Quarry property boundary as part of the Land Disposal Areas RFI including monitor wells MW-32, MW-33, MW-34S and MW-34D.

The spacing between monitoring wells in the shallow aquifer in the BTF & Sewers area probably averages 400 feet along the property boundary (Figure 2-10).

Shallow monitor wells were installed along the property boundary to determine the absence or presence of contamination adjacent to the Polishing Pond and the Equalization Basin. MW-11 and MW-12 installed along the property boundary downgradient of SWMU 13 are approximately 120 ft apart. Additional monitor wells were proposed north and south of MW-17 in the BTF and Sewers RFI Report recommendations (Section 6.5, page 110) to delineate the extent of benzene contamination. The proposed monitor wells will be moved to 100 ft from MW-17 to reduce the well spacing used to delineate the extent of benzene.

The spacing between monitoring wells in the deep aquifer is much greater (Figure 2-11) and few of the deep wells are located down gradient from specific SWMUs.

The deep piezometers were installed as part of the Facility-Wide Investigation in areas where significant shallow groundwater was not encountered during drilling and were not intended to be SWMU delineation wells.

Contaminated groundwater is present, but no groundwater plumes have been identified. Groundwater velocities as high as 9,000 ft/year are reported (BTF and Sewers report, p. 82). Contaminant retardation in the fractures of the Conasauga Limestone is likely to be negligible, so movement rates of dissolved contaminants are likely to be similar to groundwater movement rates. Matrix diffusion will be negligible. No evidence supporting natural attenuation is presented. No evaluation of the extent of off-site contamination has occurred. The extent of groundwater contamination has not been defined at SWMUs in the BTF and Sewers area.

Since the intent of the Phase I RFI was to determine if groundwater contamination was present or absent at SWMU 22 and the BTF SWMUs, natural attenuation data was not collected. After the extent of contamination is delineated, data will be collected to evaluate natural attenuation processes. Then upgradient, downgradient, sidegradient and plume wells can be selected for the natural attenuation evaluation.

Evaluation of the extent of off site contamination will be assessed during Phase II of the RFI. Installation of the additional wells in the BTF area during the BTF and Sewer Addendum investigation conducted in 1999 has provided sufficient information to delineate the extent of benzene groundwater contamination and DNAPL in the BTF area (SWMUs 13 through 21). Additional monitor wells are being installed at SWMU 22 during the Phase II RFI to delineate the extent of benzene in groundwater at MW-17. Monitor wells will be installed at SWMU 4 and 37 during the Phase II RFI to determine the absence or presence of groundwater contamination at these SWMUs.

The situation for contaminated soil is similar. The extent of contaminated soils have not been defined on any of the maps in the BTF and Sewers report. Volumes of contaminated soil are not estimated in the BTF & Sewers report, so basic site characterization factors typically included in a RFI report have not been prepared for the Corrective Measures Study investigations.

The extent of soil contamination in the BTF area was delineated in Figure 4-4. Soil contamination was found in one monitor well borehole at SWMU 22. The soil contamination found in the BTF area and at SWMU 22 was located at or near the top of the bedrock and is most likely due to historical disposal practices in this area and not the current BTF SWMUs. Soil was not present around SWMU 37 since this SWMU was installed in bedrock. Physical conditions along the BTF Sewer (SWMU 4) (railroad tracks to the west and EPA sewer to the east) preclude the delineation of soil contamination east and west of the BTF Sewer. The BTF sewer line is still active and soil borings have to be carefully installed so the sewer line is not damaged. Monitor wells were

proposed in the RFI recommendations to evaluate the impacts of the low levels of soil contamination on the groundwater.

SPECIFIC COMMENTS

Comment 1:

The concentration of benzene in groundwater from MW17 exceeds the MCL (page 91) for benzene by a factor of 3 (Table 4-19). There are no other wells nearby. The benzene concentration may not be from the center of the plume, therefore higher benzene concentrations may be present in groundwater leaving the site. MW17 is located at the edge of the Sloss property. Figure 2-10 shows that groundwater flow directions from MW17 are northward, therefore, groundwater contaminated with benzene in excess of the MCL is moving north-eastward, off site. None of the figures in the report show the extent of groundwater contamination in the vicinity of SWMU22. The extent of groundwater contamination has not been defined.

Response:

The intent of the Phase I RFI was to determine the presence or absence of groundwater contamination at SWMU 22. Three additional monitor wells were proposed in the BTF and Sewers RFI recommendations (Section 6.5) to delineate the extent of benzene in the MW-17 area. As discussed above the monitor wells located north and south of MW-17 will be relocated to approximately 100 ft from MW-17 to reduce the well spacing. Additionally, as proposed in the RFI Report a deep monitor well will be drilled at the MW-17 location. A monitor well cannot be installed west of MW-17 because the Polishing Pond is located in this area.

A monitor well will also be installed northeast of MW-17 on the east side of the drainage ditch. The proposed monitor well location is approximate and will be finalized pending negotiation of access agreements with off site property owners and field evaluation of site access since woods and railroad tracks are located east of the drainage ditch. The monitor well will be installed and developed in accordance with the RFI Work Plan. Groundwater samples will be collected from the new well in accordance with the RFI Work Plan. The samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Priority Pollutant (PP) metals, barium, and cyanide.

Comment 2:

Please clarify the number of monitoring wells which were sampled. The text at the beginning of section 3.9.1, page 43 states "A total of twenty (17) wells..." were sampled.

Response:

Seventeen monitor wells were sampled. The text will be corrected.

Comment 3:

The presence of DNAPL in MW3 and MW4A, coupled with the low pH of the influent and effluent at SWMU13 (BTF and Sewers, p. 16, locations on Figure 2-12) suggests the potential for deep contaminant migration in the limestone aquifer. The secondary porosity of the Conasauga Formation limestones underlying the SWMU13 area may have been enhanced and contaminant migration from the site may be more rapid than in other areas. The extent of NAPL contamination, rates of contaminant migration and degradation should be determined. Natural or man-made discharge areas and potential receptors should be identified, which can not be done until the extent of contamination has been defined.

Response:

There is approximately 10 to 20 ft of clay between the bottom of the Equalization Basin (SWMU 13) and the top of the bedrock. Any cracks present in the clay would most likely have been sealed by the coal tar that coats the bottom of the basin. The pH (6.7 to 7.6) of the groundwater samples collected at SWMU 13 indicates that groundwater has not been influenced by this SWMU.

The extent of DNAPL contamination was delineated in the BTF and Sewers Addendum Report (Figure 4-6). The DNAPL is a very viscous coal tar material and it is not expected to be mobile. (The DNAPL cannot be pumped by a peristaltic pump and has to be bailed from MW-4A.) The DNAPL release most likely occurred prior to 1974 when untreated wastes were discharged directly to the BTF area. Based on the appearance of the DNAPL in MW-4A and the total analytical results (Table 4-7), the DNAPL does not appear to be degrading. Naphthalene and benzene are the only compounds which been detected in site groundwater in the area where the DNAPL is located.

There are no natural or manmade groundwater discharge areas in the BTF area.

Comment 4:

Section 4.1 is titled "BTF Equalization Basin and BTF Emergency Basin (SWMUs 13 and 21)". Most of the paragraphs in this section refer to "SWMUs 13 and 21", but there are two references to "SWMUs 13 and 22" on page 63. SWMU 22 isn't very far away, but probably wasn't meant to be included in this section. Please verify whether the references to SWMU 22 in Section 4.1 are typographical errors and make corrections if necessary.

Response:

The references to SWMU 22 are typographical errors. The text will be revised to say SWMUs 13 and 21.

BTF and Sewers Draft RFI Addendum Report

GENERAL COMMENT

Comment:

The description of procedures used to purge the monitoring wells prior (page 10) to sampling indicates that low flow purging procedures are not be used. Purge pumps are lowered in the well as water levels decline (page 10). The amount of which the pump may be lowered is not specified, but the text states that some wells are pumped until dry. The EPA Region 4 SOP specifically recommends that wells should not be pumped until dry when purging. Some purge rates presented in Appendix A exceed 2.6 liters/minute, which greatly exceeds rates recommended for low-flow purging.

When the discharge rate exceeds the well yield, the increased hydraulic gradient between the formation and the well can mobilize particles, elevating turbidity. Continued removal of water can dewater the filter pack, leading to gravity drainage of pore water and sediments, further increasing turbidity. Table 3-3 shows that 5/7 turbidity values reported this report exceeded the Region 4 SOP recommendation for a maximum turbidity of 10NTU in groundwater samples. One of the samples which didn't exceed this recommendation had a turbidity of 9.4NTU.

Over-pumping during purging can result in loss of volatile compounds from the water and false positive results for metals. Samples which include metals sorbed on normally immobile matrix particles may bias analytical results if suspended particle concentrations are very high, leading to elevated concentrations of contaminants. This is known to be particularly applicable to metals, but may apply to other contaminants, such as PAHs and pesticides. In general, the purging process should not lower the water level in the well more than a few tenths of feet. Low flow purge rates between 0.1 and 0.3 liters/minutes can be achieved with peristaltic or bladder pumps. The depths to water shown on Table 3-1 indicate that peristaltic pumps could be used at many of the wells at this site. Bladder pumps probably could be used at the deeper wells. Regardless of the type of pump used, "... the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen" (EPA, 1996, Section V).

Low flow procedures should be adapted for future sampling events where possible. The text refers to methods for collecting VOCs which are described in the QAAP. However, if a bailer is being used, VOCs can be collected from purged wells using the tube & glove method (EPA Region 4 SOP Section 7.3.3), rather than a bailer. Samples for metals should not be collected until a reasonable effort is made to reduce the turbidity to less than 10NTUs. EPA Region 4 has achieved this goal in temporary (direct push) wells using peristaltic pumps powered by motorcycle batteries. Purging times may be as long as a few hours, however, a single operator with multiple pumps and batteries can purge numerous wells simultaneously, producing less water for disposal and assuring better quality samples. The cost for a "reasonable effort to reduce turbidity below 10 NTU" must be weighed against the cost of subsequent meetings and reports arguing that high metals concentrations are false positive results which may be the result of turbid samples.

Response:

Sloss will begin to use low flow sampling during the 2001 field investigation. The screens in monitor wells MW-38 through MW-43 were installed across the overburden (clay)/rock interface to delineate the extent of DNAPL and LNAPL in the MW-4A and MW-6 areas, respectively. Sloss will use low flow sampling procedures to sample these wells during subsequent sampling events; however, since these wells are screened partially in clay, the turbidity problems may persist. Samples for metals will not be collected if the Tubidity is above 10 NTUs. Every effort will be made to keep wells from pumping dry. However, some monitor wells are installed in bedrock with very little secondary permeability and they may still pump dry even at low flow sampling rates.

SPECIFIC COMMENTS

Comment 1:

Figures 4-4 and 4-7 show that in the vicinity where DNAPL has been observed near MW4A, the first MW10 borehole and MW3, a trough in the bedrock surface generally coincides with the course of a "Pre-RCRA stream" which used to drain the area. Figure 4-4 shows that the DNAPL at MW4A is on a bedrock high. Does DNAPL from the vicinity of MW4A move down the bedrock surface toward the bedrock trough? Does the old stream channel influence groundwater flow directions and contaminant pathways? Please explain.

Response:

Based on the viscosity of the coal tar material, the DNAPL is most likely not moving. The coal tar is residual material that infiltrated into fractures in the bedrock when untreated waste was discharged directly into this area. More DNAPL appears to be present in MW-4A than in wells installed in the bedrock trough. Over five feet of DNAPL has been measured in MW-4A, whereas in MW-3, DNAPL was found on the pump when this well was being redeveloped but has not accumulated in the well. This may be due to the presence of more secondary porosity in the limestone pinnacle where MW-4A is located. The limestone pinnacle would have been exposed to more weathering than the limestone in the trough.

The old stream channel does not appear to influence groundwater flow directions and contaminant pathways. Based on the groundwater data collected in this area since 1995, the groundwater flow direction is being influenced by dewatering in the Southern Ready Mix Quarry rather than the bedrock topography. If the dewatering was discontinued in the Southern Ready Mix Quarry, the groundwater flow would most likely be towards Five Mile Creek which is a major hydrologic boundary. The groundwater flow would than follow the path of the old stream channel which is oriented north-south towards Five Mile Creek.

Comment 2:

Figure 4-5 shows shallow groundwater contours crossing the ditch on the east side of the site. The interpretation shows that the ditch was not the discharge area for shallow groundwater in this area, and does show that groundwater from the vicinity of SWMU13 leaves Sloss property and crosses the railroad tracks.

Elevations from U.S.G.S. Birmingham North topographic map suggest that the groundwater flow directions near SWMU13 may not be correct. The ditch drains toward the north, yet the groundwater contours show that groundwater between MW5 and MW12 flows across the ditch to the southeast. Are the ditches connected to the shallow groundwater flow system? Could buried stream beds, ditches or storm drains be diverting shallow groundwater from the SWMU13 area. What is the water level in the equalization basin (SWMU13)? SWMU13 has a clay liner and therefore leakage from the pond may create a mound on the water table. Does the basin or the surface water drainages south of the basin affect groundwater flow directions? The presence of LNAPL and DNAPL in this area (Figure 4-6), make interpretation of groundwater flow directions (Figure 4-5), the bedrock topography (Figure 4-4), and the relationships between surface water drainage and the equalization pond critical. Is there any evidence for the existence of a unsaturated zone beneath the pond?

Figure 4.5 shows that groundwater contamination from the LNAPL at MW6 would have to be 30 feet wide in the vicinity of MW42 for the edge of the plume to be detected at MW42. If it can be shown that surface water drainages influence groundwater flow directions, a plume might be better defined using the surface water data combined with water level elevations. If additional wells are necessary to define the plume, the location selection process should consider surface water as potential groundwater discharge areas.

Please re-evaluate the water level contours presented on Figure 4-5 considering the effects of surface water discharge areas and the potential for mounding of the water table beneath SWMU13.

Response:

The storm water drainage ditch that is located south and east of SWMU 13 is a shallow ditch approximately 1-2 ft deep. The depth to the top of bedrock along the eastern drainage ditch is between 8 and 13 ft bls and along the western ditch is between 6 and 13 ft bls. Since the ditch is approximately 1-2 ft deep, the drainage ditch doesn't intersect the bedrock surface. The shallow Conasauga aquifer is under confined or semi-confined conditions in the BTF area and there is a downward vertical gradient in the limestone between MW-5S and MW-5D located adjacent to the drainage ditch. The ditches may recharge the groundwater flow system during rain events; however, groundwater does not appear to discharge into the shallow ditch.

Although the USGS map suggests that topography slopes to the north, dewatering in the Southern Ready Mix Quarry is influencing the shallow groundwater flow system by lowering the potentiometric surface and changing groundwater flow to the southeast.

There are no buried streambeds or storm drains in the BTF area. In the area where the BTF was installed, the pre-RCRA streambeds were removed and replaced by clay fill material that ranges from 16 to 24 ft thick.

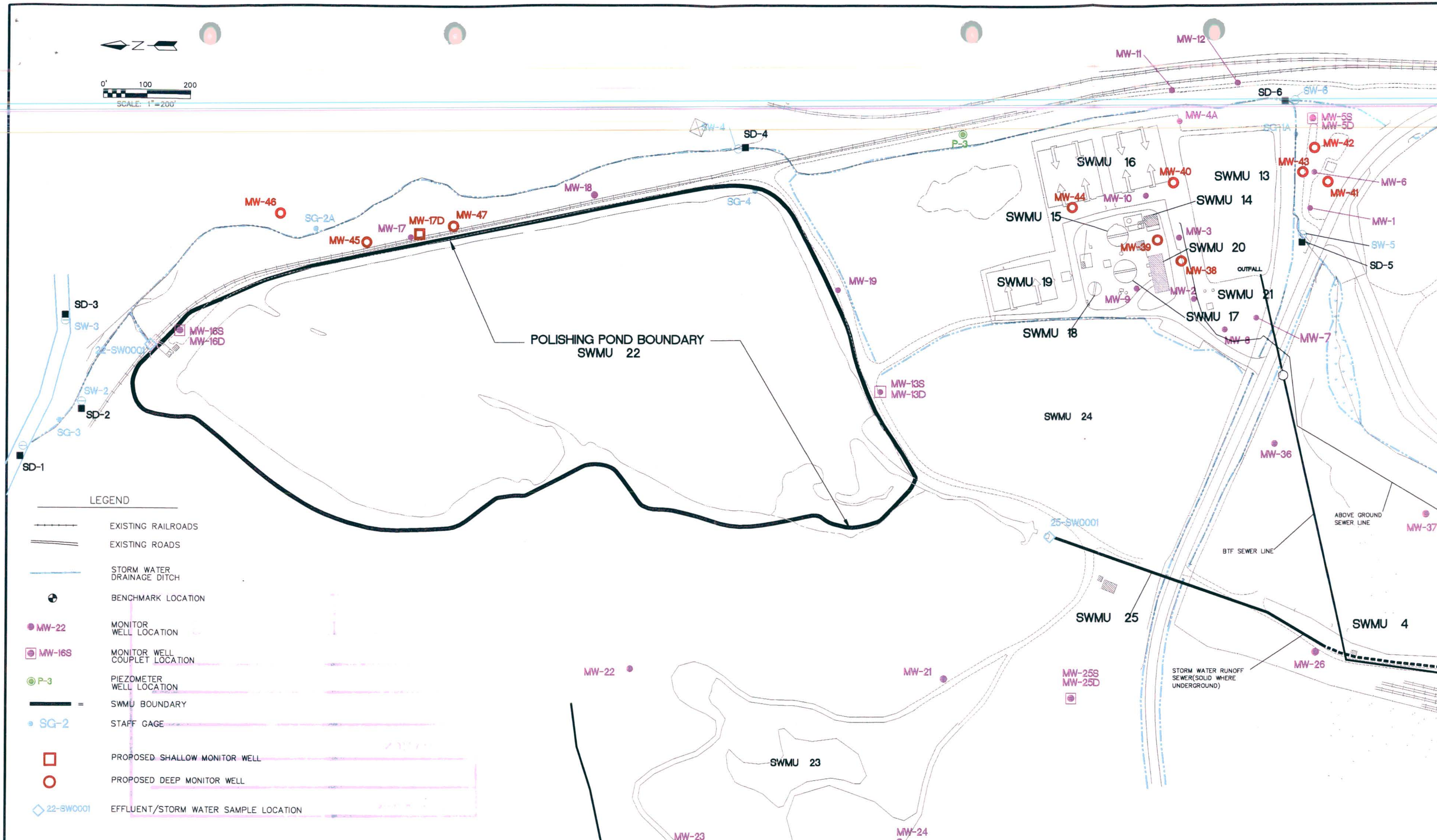
The equalization basin is approximately 5 ft deep and the water in the basin is perched since 10 to 20 feet of clay is present between the basin and top of bedrock. The basin is coated with coal tar from Coke Plant wastes. Any cracks in the clay would have been in-filled with the coal tar, which is an effective sealant, and there should be no leakage from

the pond. Additionally, groundwater data does not indicate that a mound is present beneath the basin.

The basin and surface water drainage ditches south of the basin do not appear to effect groundwater flow directions in the limestone aquifer. The absence of a groundwater mound under the basin and lithologic data collected during installation of monitor wells MW-7, MW-38, and MW-40 around the perimeter of the basin indicate that the clay is not saturated.

As discussed above, the surface water drainage does not appear to be influencing the shallow groundwater flow direction. The LNAPL in MW-6 is localized in extent and the source of the LNAPL appears to be the adjacent ABC Coke gas pipeline drip leg. Since the Sloss pre-RCRA waste stream and SWMUs 13 and 21 do not appear to be the source of the LNAPL, no further action is warranted in the area by Sloss Industries.

Sloss has re-evaluated the water level contours on Figure 4-5 and believes they are an accurate representation of the groundwater flow conditions in the vicinity of the BTF area. Due to the influence of the dewatering at the Southern Ready Mix quarry, the groundwater flow direction is to the southeast. Data indicates that the shallow limestone aquifer does not discharge into the shallow stormwater drainage ditch. Since 10 to 20 feet of clay is present beneath the equalization basin and the basin is coated with coal tar, there should be minimal leakage from the basin. Water level data does not indicate that a groundwater mound is present beneath the basin.



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PROPOSED MONITOR WELL LOCATIONS FOR SWMUs 13 AND 21, SWMU 22, AND SWMUs 14 THROUGH 19

BTF AND SEWERS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
6-1

RCRA Facility Investigation Land Disposal Areas Volume I of III

Report
(January 1998 - Revised November 2000)

ARCADIS GERAGHTY & MILLER

27 November 2000

PREPARED FOR

Sloss Industries, Inc.
Birmingham, Alabama

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LAND DIVISION

RCRA Facility Investigation Land Disposal Areas Volume I of III

Report
(January 1998 - Revised November 2000)

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GLOSSARY OF ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHC	American Industrial Health Council
AP	Averaging Period
ASI	Analytical Services Incorporated
ASTM	American Society for Testing Materials
atoc	Above Top of Casing
ATSDR	Agency for Toxic Substance and Disease Registry
bls	Below Land Surface
BSC	Benzene Sulfonyl Chloride
BTF	Biological Treatment Facility
BW	Body Weight
CDC	Center for Disease Control
CFR	Code of Federal Regulation
cm/sec	Centimeters per Second
cm^2	Square Centimeters
CNS	Central Nervous System
COC	Constituents of Potential Concern
COEC	Constituents of Ecological Concern
CSF	Cancer Slope Factor
Cveg	Constituent Concentrations in Vegetation
DNA	Deoxyribonucleic Acid
DOT	Department of Transportation
ECG	Electrocardiogram
EEC	Expected Environmental Concentrations
EF	Exposure Frequency
EI	Ecological Inventory
ELCR	Excess Lifetime Cancer Risk
EP	Exposure Period
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESD	Environmental Services Division
ESOD	Erythrocyte Superoxide Dismutase
FID	Flame Ionization Detector
FSP	Field Sampling Plan
ft	Feet
ft amsl	Feet Above Mean Sea Level
ft bls	Feet Below Land Surface
ft btoc	Feet Below Top of Casing
ft/ft	Feet per Foot
ft/sec	Feet per Second
ft/yr	Feet per Year
FWI	Facility-Wide Investigation

g	Gram
g/kg-day	Grams Per Kilogram-Day
g/m^3	Grams Per Cubic meter
GI	Gastrointestinal
gpm	Gallons Per Minute
HDL	High Density Lipid
HEAST	Health Effects Assessment Summary Tables
HHC	Hillsborough Holding Corporation
HI	Hazard Index
HQ	Hazard Quotient
HSD	Hazardous Substance Database
HSWA	Hazardous and Solid Waste Amendment
Hz	Hertz
I.D.	Inner Diameter
I.Q.	Intelligence Quotient
IDW	Investigation Derived Waste
IRIS	Integrated Risk Information System
JWC	Jim Walters Corporation
kg	Kilograms
Kg-day/mg	Kilogram-day per Milligram
K_{ow}	Octonal-Water Partitioning Coefficient
L/day	Liters per Day
1b/ft^3	Pounds per Cubic Foot
LD_{50}	Lethal Dose
LOAELs	Lowest Observed Adverse Effect Levels
m^3/ug	Cubic Meters per Microgram
MCL	Maximum Contaminant Level
mg	Milligrams
mg/cm^2	Milligrams per Square Centimeter
mg/day	Milligrams per Day
mg/kg	Milligrams per Kilogram
mg/kg/day	Milligrams per Kilograms per Day
mg/kg-day	Milligrams per Kilograms-Day
mg/L	Milligrams per Liter
mg/m^3	Milligrams per Cubic Meter
mL	Milliliter
msl	Mean Sea Level
NIOSH	National Institute of Occupational Health and Safety
NOAELs	No Observed Adverse Effect Levels
NTP	National Toxicology Program
O.D.	Outer Diameter
ORNL	Oak Ridge National Laboratory
OVM	Organic Vapor Monitor
PAH	Polycyclic Aromatic Hydrocarbon
PDF	Probability Density Function

PID	Photo Ionization Detector
PP	Priority Pollutant
ppm	Parts Per Million
PRGs	Preliminary Soil Remediation Goals
PU	Soil-to-Plant Uptake Factors
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Controls
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration
RCRA	Resource Conservation Recovery Act
RFA	RCRA Facility Assessment
RfCs	Reference Concentrations
RfD	Reference Dose
RfDos	Reference Doses for Oral Exposure
RFI	RCRA Facility Investigation
RGOs	Remedial Goal Options
RME	Reasonable Maximum Exposure
RNA	Ribonucleic Acid
SAR	Soil Adherence Rate
SD	Standard Deviation
Sloss	Sloss Industries Corporation
SQL	Sample Quantitation Limit
SSA	Skin Surface Area
SSSIC	Sloss Sheffield Steel and Iron Company
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TEF	Toxicity Equivalency Factor
TSA	Toluene Sulfonic Acid
UCL	Upper Confidence Level
μg/day	Micrograms per Day
μg/dl	Micrograms per Deciliter
μg/g	Micrograms per Gram
μg/kg	Micrograms per Kilogram
μg/L	Micrograms per Liter
Ur_i	Unit Risk Factor
U.S.	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency

VOC	Volatile Organic Compound
VSI	Visual Site Inspection
WHO	World Health Organization
Zn	Zinc

1.0 INTRODUCTION

Sloss Industry Corporation (Sloss) located in Jefferson County, Alabama, is evaluating past waste management practices in accordance with the regulations set forth by the Hazardous and Solid Waste Amendments (HSWA) of the Resource Conservation Recovery Act (RCRA) (Figure 1-1). In August 1990, ARCADIS Geraghty & Miller, Inc. was contracted by Sloss to prepare and implement a RCRA Facility Investigation (RFI) Work Plan for 39 solid waste management units (SWMUs) identified at the Sloss Facility during the RCRA Facility Assessment (RFA) (Figure 1-2). A RFI Work Plan was prepared and approved by the United States Environmental Protection Agency (USEPA) in May 1995. The Work Plan describes the investigations that will be conducted to characterize the nature, extent, and rate of contaminant migration from the SWMUs identified at the Facility.

In the RFI Work Plan, the SWMUs were separated into four separate areas: Coke Manufacturing Plant, Land Disposal Areas, Biological Treatment Facility (BTF) and Sewers, and Chemical Manufacturing Plant (Table 1-1 and Figure 1-2). These areas were created to group similar industrial activities together and allow for a systematic implementation of the investigation activities at each area. Initially, a Facility-Wide investigation (FWI) was completed in June through August 1995 to develop a conceptual hydrogeologic and hydrologic model of the Sloss Facility. The conceptual model details information on groundwater and surface water flow for use in assessing possible contaminant transport for future SWMU investigations. The RFI Facility-Wide Report was submitted to the USEPA in February 1996.

After completion of the RFI Facility-Wide Report, Sloss began focusing on the areas within the Facility as specified in the RFI Work Plan. Each of the four areas (Coke Manufacturing Plant, Land Disposal Areas, BTF and Sewers, and Chemical Manufacturing Plant) are being sequentially investigated and evaluated. The Coke Manufacturing Plant investigation was conducted in June 1996 and the RFI report for this area was submitted to the USEPA in February 1997. The Land Disposal Areas investigation was conducted from June to August 1997. RFIs for the remaining SWMU areas will be implemented in 1998 (BTF and Sewers), and 1999 (Chemical Manufacturing Plant). This RFI Land Disposal Areas Report summarizes the results of the Land Disposal Areas investigation.

1.1 SITE BACKGROUND

The Sloss Facility began operation in 1919 as Sloss Sheffield Steel and Iron Company (SSSIC) producing foundry and furnace coke and coke by-products. The Coke Manufacturing Plant consisted of five coke batteries which contained 240 coke ovens. Coke batteries 1 and 2, consisting of 120 coke ovens, were taken out of service in 1979. The coke product, produced through a process of carbonization, is sold primarily to the steel industry as furnace coke. The Coke Manufacturing Plant is currently operating and is located at the southwest part of the Sloss Facility (Figure 1-2).

In 1939, SSSIC merged with United States Pipe and Foundry Company and in 1948 the Facility constructed a Chemical Manufacturing Plant, which produced Toluene Sulfonic Acid (TSA) 94. Sloss later expanded operations by manufacturing sulfones through a sulfonization process of sulfuric acid and benzenesulfonyl chloride (BSC). The Chemical Manufacturing Plant is located at the southeast part of the Sloss Facility and is currently operating (Figure 1-2).

A Mineral Wool Plant was constructed northeast of the Chemical Manufacturing Plant in 1950 and is currently operating (Figure 1-2). The plant manufactures mineral fibers which are used for ceiling tiles and insulating products.

In 1958, an iron blast furnace began operation at the Facility and produced pig iron from iron ore. The blast furnace ceased operation in 1979 and was removed in 1984.

Jim Walter Corporation (JWC) bought this Facility in 1960 and constructed a BTF located in the northern part of the Sloss Facility in 1973 (Figure 1-2). The BTF was designed to treat wastewater generated at the Facility. The wastewater that is generated enters a BTF Sewer System and is directed to the northeast part of the Facility where the BTF is currently operating. In 1988, the JWC sold controlling interest to Hillsborough Holding Corporation (HHC), and Sloss Industries Corporation became a wholly-owned subsidiary of HHC.

1.2 OBJECTIVES

The objectives of the Land Disposal Areas RFI are to: (1) confirm the presence or absence of contamination at the site; (2) determine the extent and degree of contamination at the site; (3) identify and characterize the sources of contamination for the site; (4) assess the potential for contaminant migration to surrounding environments; (5) identify public health and environmental risks of any contaminants; and (6) define the scope of future investigations and/or actions at the site.

To meet the RFI objectives, each of the identified Land Disposal Areas SWMUs were evaluated to assess whether releases to the environment have occurred. The presence or absence of contamination was investigated at each Land Disposal Areas SWMU by collecting samples of potentially affected media (sludge, subsurface and surficial soil, and groundwater). Geophysical surveys (seismic, conductivity, and resistivity surveys) were performed around the perimeters of SWMU 23 and SWMUs 38 and 39 to provide data on the depth to bedrock and identify areas with highly conductive materials in the soil or groundwater. A risk assessment was prepared to identify public health and environmental risks of any contaminants. Additionally, data collected during the Land Disposal Areas RFI was also used to revise the conceptual site model which was developed during the FWI and subsequently modified with data collected during the Coke Manufacturing Plant investigation.

1.3 SCOPE

The land disposal operations at the Sloss Facility consists of three distinct areas (SWMU 23, SWMU 24, and SWMUs 38 and 39) for purposes of this investigation. These SWMUs are areas where materials generated from various on-site processes have been placed on the ground. SWMUs 38 and 39 are two adjacent units and are being evaluated as one unit hydrogeologically because of their close proximity.

Area 1 - Biological Sludge Disposal Area (SWMU 23): The RFI investigation for SWMU 23 consisted of the following tasks:

1. Seismic and conductivity geophysical surveys: The seismic survey was conducted to provide data on the depth to bedrock and the conductivity survey was conducted to identify areas with highly conductive materials in the soil and groundwater.

2. Sludge sampling: Sludge sampling was performed to evaluate the potential contaminants present in the sludge material and assess the potential for these constituents to leach from the sludge.

3. Installation of soil borings and soil sampling: Subsurface soil sampling was conducted to confirm the presence or absence of soil contamination at the monitor well locations.

4. Installation of six monitor wells: The monitor wells were installed to collect lithologic data, water level data, evaluate the hydraulic conductivity of the aquifer, and assess groundwater quality.

5. Hydraulic conductivity testing of the aquifer: Aquifer tests were conducted on each monitor well in order to determine hydraulic conductivities and groundwater flow velocities.

6. Groundwater sampling. Groundwater sampling was conducted to confirm the presence or absence of groundwater contamination at SWMU 23.

Area 2 - Blast Furnace Emission Control Sludge Waste Pile (SWMU 24): Sludge sampling was performed to evaluate the potential contaminants present in the sludge material and assess the potential for these constituents to leach from the sludge. Soil sampling was conducted to confirm the presence or absence of soil contamination around the waste pile.

Area 3 - Landfill (SWMU 38) and Blast Furnace Emission Control Sludge Waste Pile (SWMU 39): The RFI investigation for SWMUs 38 and 39 consisted of the following tasks:

1. Seismic, conductivity, and resistivity geophysical surveys: The seismic survey was conducted to provide data on the depth to bedrock and the conductivity and resistivity surveys were conducted to identify areas with highly conductive materials in the soil and groundwater.

2. Sludge sampling: Sludge sampling was performed at SWMU 39 to evaluate the potential contaminants present in the sludge material and assess the potential for these constituents to leach from the sludge.

3. Installation of soil borings and soil sampling: Subsurface soil sampling was conducted to confirm the presence or absence of soil contamination at the monitor well locations.

4. Installation of 14 monitor wells: The monitor wells were installed to collect lithologic data, water level data, evaluate the hydraulic conductivity of the aquifer, and assess groundwater quality.

5. Hydraulic conductivity testing of the aquifer: Aquifer tests were conducted on each monitor well in order to determine hydraulic conductivities and groundwater flow velocities.

6. Groundwater sampling: Groundwater sampling was conducted to confirm the presence or absence of groundwater contamination at SWMUs 38 and 39.

Risk Assessment: Using data generated from the RFI, a health and environmental assessment was prepared to evaluate the risks associated with the Land Disposal Areas SWMUs.

2.0 STUDY AREA

2.1 TOPOGRAPHY

Sloss is located in the Birmingham Valley District of the Alabama Valley and Ridge Physiographic section. The Birmingham Valley trends northeast-southwest and is characterized as essentially flat, low lying, and is bound to the southeast by Red Mountain and to the northwest by Sand Mountain (Figure 2-1).

Land surface elevations on the Sloss Facility range between 540 and 560 feet above mean sea level (ft amsl) except at the northwest portion of the Facility where Sand Mountain is exposed. Approximately 180 feet of relief is present from Sand Mountain to the Sloss Facility. Drainage from Sand Mountain trends southeast directing surface water toward the Sloss Facility (Figure 1-1).

2.2 SURFACE WATER

The Sloss Facility lies in the Black Warrior River Basin. Two tributaries of the Locust Fork of the Black Warrior River occur in the vicinity of the Sloss Facility, Five Mile Creek located along the northern boundary of the Facility and Village Creek located approximately 1.5 miles south of the Facility. In the vicinity of the Sloss Facility, Five Mile Creek flows to the west and Village Creek flows to the southwest.

Surface water at the Sloss Facility is limited to a drainage ditch located along the eastern property boundary of the Sloss Facility. This drainage ditch is located north of SWMU 38 and extends from near monitor well MW-32 located adjacent to the LaFarge Quarry northward to Five Mile Creek where it discharges (Figure 2-2). Several drainage ditches which collect storm water runoff are also located adjacent to the Land Disposal Areas SWMUs. Storm water drainage ditches are located north and south of Summit Street which is located between SWMUs 38 and 39 and SWMU 24 and east of SWMU

24 along the driveway into the BTF. Additionally, a swale is located along the northern boundary of SWMU 24. SWMU 25, the Storm Water Runoff Sewer, which collects storm water and non-contact cooling water from the Sloss Facility, is located along the northwestern boundary of SWMUs 38 and 39 and approximately 50 feet west of SWMU 24. There are no surface-water bodies in the Land Disposal Areas SWMUs; however, SWMU 22, the Polishing Pond, which is a large surface impoundment, is located north of SWMU 24. Water from SWMU 25 drains into the polishing pond before permitted discharge to Five Mile Creek.

2.3 GEOLOGY

2.3.1 Regional Setting

The Sloss Facility is situated within the Valley and Ridge province at the southern end of the Appalachian Mountains (Figure 2-1). The Valley and Ridge province in the Birmingham area is underlain by more than 10,000 feet of sedimentary rock that range in age from Cambrian to Holocene. A generalized stratigraphic section of rocks in the area is presented in Figure 2-3. The Valley and Ridge Province is a structurally complex geologic feature that developed at the end of the Paleozoic Era in response to tectonic stresses during the deformation of the Appalachian fold mountain belt. Northwest trending faults and folds and thrust faults are typical of the Appalachian fold mountain belt. Structurally, the Valley and Ridge Province includes the Birmingham anticlinorium, Cahaba synclinorium, and the western edge of the Coosa synclinorium which are generally faulted and folded (Kidd and Shannon, 1977) (Figures 2-4 and 2-5). After development of the Valley and Ridge Province, the structures were subsequently modified by erosion.

The Birmingham anticlinorium is a major thrust faulted fold which trends northeast-southwest (Thomas and Bearce, 1986). The Sloss Facility is located on the Blount Mountain syncline which is the northwest limb of the Birmingham anticlinorium (Figure 2-5).

Several structural features are present on the Birmingham anticlinorium including the Opossum Valley thrust fault, which occurs in the area of the Sloss Facility, and the Jones Valley thrust fault (Figures 2-4 and 2-5). The Opossum Valley thrust fault is a northeast-southwest trending fault located on the northwestern limb of the Birmingham anticlinorium. It has a displacement of 7,000 feet or more where older carbonate rocks of the Conasauga Formation, Ketona Dolomite, and Knox Group have been thrusted from the southeast over younger Paleozoic clastic rocks (Kidd and Richter, 1979). Numerous faults and fault splays are associated with the Opossum Valley fault, and formations immediately west of the fault are typically overturned, deformed, and faulted (Kidd and Richter, 1979).

2.3.2 Facility Geology

The Sloss Facility is underlain by sedimentary rocks that range in age from Cambrian to Pennsylvanian as presented in Figure 2-6, a geologic map of the site. South of Summit Street, the Opossum Valley fault trace is located at the northwest perimeter of the Sloss Facility property. North of Summit Street in the BTF area, the Opossum Valley fault trace bisects the property in the area of the Polishing Pond (Figure 2-6). The hanging wall of the fault is located in the Sloss Facility plant area and the footwall of the fault is located on and adjacent to Sand Mountain (Figure 2-6).

Northwest of the Opossum Valley fault trace, on the footwall of the fault, the Sloss Facility including SWMU 23 is underlain by strata ranging from Silurian to Pennsylvanian in age (Figure 2-6). A fault slice of folded strata ranging in age from Silurian and older to Mississippian, which is part of an anticline structure, is present between the hanging wall and footwall of the Opossum Valley fault (Figure 2-6). The rocks exposed on Sand Mountain are inclined and dip to the southeast from 28° to 77°.

Southeast of the Opossum Valley fault trace, on the hanging wall of the fault, the Sloss Facility including SWMU 24 and SWMUs 38 and 39, is underlain by the Conasauga

Formation of Cambrian Age as presented in Figure 2-6. The rocks in the Conasauga Formation are inclined and dip to the southeast from 26° to 35°. A northeast-southwest geologic cross section of the Sloss Facility which bisects SWMU 24 and parallels the northwestern boundary of SWMUs 38 and 39 was constructed along the line indicated in Figure 2-2. The northeast-southwest cross section is presented in Figure 2-7.

The Conasauga Formation, which underlies the Land Disposal Areas, varies from 1,100 to 1,900 feet in thickness. In the area of the Opossum Valley fault, the stratigraphic thickness of the Conasauga Formation is probably much thinner than 1,100 to 1,900 feet. The Conasauga Formation consists of relatively few micrite zones, with larger proportions of very fine grained sparite and argillaceous sparite, and several zones containing somewhat dolomitic edgewise conglomerates (Brockman, 1978). The micrite tends to be light-gray, the sparite being darker in color, and the argillaceous rocks being darker than the purer limestone.

Lithologic data collected during the FWI indicates that the top two feet of the Conasauga Formation at most locations is composed of highly weathered limestone. Below the upper weathered surface of the Conasauga Formation, the limestone was generally massive with very few fractures. The blocks of limestone encountered during the FWI drilling were typically, medium gray in color and hard with thin (1- to 2-foot) lenses of softer, darker gray shale and shaley limestone; however, occasionally thin (2- to 12-inch) fracture zones were encountered. The limestone in these fracture zones was usually broken up and any remaining voids were infilled with calcite crystals. Areas of fractured limestone were generally within the upper 50 feet of the Conasauga Formation and became more infrequent with greater depth. Based on lithologic and geophysics data, the Conasauga Limestone at depth appears to be hard with little secondary porosity.

The underlying rocks of the Sloss Facility have been structurally deformed in response to thrust faulting, resulting in the development of an extensive network of faults and joints. The stress associated with the folding and faulting has created major joint traces in the Conasauga Formation which trend northeast and northwest at the Sloss Facility. Two systematic sets of joints were found in quarries adjacent to the site, one set strikes approximately N45°E and dips approximately 60°NW and are approximately perpendicular to bedding and the second set strikes N30°W and has subvertical dips. Many of the joints of both sets are calcite healed, although some were observed to have reopened.

2.3.3 Bedrock Topography

The bedrock topography of the Sloss Facility generally slopes to the north towards Five Mile Creek and top of bedrock elevation ranges from 574.2 ft amsl at the southwestern end of the site to 507 ft amsl near Five Mile Creek. In the Land Disposal SWMU Area, the bedrock elevations range from 517.8 to 625.7 ft amsl (Figure 2-8). Bedrock elevations in the area of SWMU 24 and SWMUs 38 and 39 range from 517.8 to 554.5 ft amsl and bedrock elevations on Sand Mountain (SWMU 23) range from 532.8 to 625.7 ft amsl. Depth to bedrock in the SWMU 24 and SWMUs 38 and 39 area is generally between 11 and 23 feet below land surface (ft bls) and the depth to bedrock on Sand Mountain ranges from 0 to 38 ft bls. Weathering of the Conasauga Formation has produced an undulating bedrock surface where several feet of relief has developed over tens of feet in some areas of the site (Figure 2-8).

2.4 SOILS

2.4.1 Facility-Wide Soils

Residual soil from weathered Conasauga Formation limestone overlies the majority of the Sloss Facility including the Land Disposal Areas; however, on and adjacent to Sand Mountain where SMWU 23 is located, residual soils have formed on the red Mountain Formation, the Ft. Payne Chert, the Tuscumbia Limestone, the Hartselle Sandstone, the Floyd Shale, and the Pottsville Formation (sandstone and shale) (Figure 2-6). According to the Soil Survey of Jefferson County, Alabama (Spivey, 1982), soils on Sand Mountain consist of Tupelo silt loam and Allen-Urban land complex. Tupelo silt loam is nearly level to gently sloping, moderately well drained soil located on uplands of limestone valleys. The Allen-Urban land complex consists of strongly sloping, well drained Allen fine sandy loam and areas of Urban land located on mountain foot slopes and uplands of limestone valleys. Urban soils, where the original soil was altered by cutting and filling, shaping and grading, excavation, blasting, compacting, or covering with concrete or asphalt, occur on the remainder of the Facility. Where the original soil has not been disturbed, residual soil from weathered Conasauga limestone is present.

Lithologic data collected during the FWI indicates that in general, native soils at the Sloss Facility consist of cohesive, medium stiff to stiff inorganic clays of low to medium plasticity (CL) and high plasticity (CH) with color ranging from reddish brown to orangish yellow to very pale orange. General engineering properties based on analytical and visual observations of site soil properties include: high shrink-swell potential, low permeability, and low strength capabilities. Laboratory analysis of nine shelby tubes collected during the FWI identified the following ranges for geotechnical parameters which are consistent with the general engineering properties identified for site soils: coefficient of permeability 1.9 x 10^{-6} to 5.4 x 10^{-8} centimeters per second (cm/sec); wet and dry porosity 0.59 to 0.84 and 0.39 to 0.55, respectively; wet and dry density 112.8 to 129.2 pounds per cubic feet (lb/ft^3) and 77.1 to 104.6 lb/ft^3, respectively; and specific gravity 2.70 to 2.81. The low permeability of native soils will act as a barrier to mitigate the downward migration of any constituents of concern

Soil thickness at the Sloss Facility ranges between 0 and 38 feet thick. The soil at SWMUs 38 and 39 ranges between 11 and 23 feet thick. On Sand Mountain, surrounding SWMU 23 soil thickness ranges from 0 to 38 feet thick. The soil is thickest on Sand Mountain in the area of monitor well MW-23 (38 ft), and thinnest, along the railroad tracks near piezometer P-20 and on Sand Mountain near monitor well MW-22. As indicated above, some areas of the Sloss Facility have been altered as a result of construction of the facility. Soils in the vicinity of SWMU 24 and SWMUs 38 and 39 have been replaced by non-native materials (eg. sludge, fill) in many locations.

2.4.2 Background Soil

Two areas located on Sand Mountain were selected as background soil boring locations in areas which appeared, according to historical aerial photographs, to be minimally disturbed by industrial activity. One area (SB-1, SB-2 and SB-3) was located south of Summit Street adjacent to power transmission lines where the grass is periodically maintained and the second area (SB-4, SB-5, SB-6) was located adjacent to the dirt road which trucks used to transport sludge to the Biological Sludge Disposal Area (SWMU 23) (Figure 2-8).

Background soil samples SB-1, SB-2, and SB-3 collected south of Summit Street consisted of a stiff, reddish-brown to yellowish-orange, clay (CH-CL) with minor black to yellowish orange mottling. Background soil samples SB-4, SB-5, and SB-6, collected upgradient of SWMU 23, consisted of a soft to stiff, yellowish-orange, clay to sandy clay (CL) with minor red mottling and chert fragments. A light brown, silty sand was encountered in the upper four feet of SB-4.

Background soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Priority Pollutant (PP) metals, barium, and cyanide to evaluate background soil quality at the Sloss Facility. Analytical results are presented in Table 2-1. Trace concentrations of VOCs including methylene chloride, tetrachloroethene, toluene, 1,1,2-trichloroethene, and trichloroethene were detected in background soil borings at concentrations well below the USEPA Region III Residential Risk-Based Concentrations (RBCs) for soil ingestion (USEPA, 1997a). These low concentrations of VOCs may be a result of vehicular traffic, industrial emissions, and weed maintenance. Tetrachloroethene, which degrades to trichloroethene, is used as a solvent and in soil sterilization, weed killers and insecticides.

Low concentrations of polycyclic aromatic hydrocarbons (PAHs) were detected in background soil borings at concentrations below USEPA Residential RBCs for soil ingestion (Table 2-1). Additionally, bis(2-ethylhexyl)phthalate and di-n-butylphthalate were detected at concentrations below the USEPA Residential RBCs for soil ingestion.

Concentrations of arsenic, beryllium, barium, chromium, copper, lead, nickel, thallium, zinc and mercury were detected in the background soil samples. Only arsenic was detected at concentrations exceeding USEPA Residential RBCs for soil ingestion (Table 2-1). The reported concentrations however are within the observed common range for trace elements in natural soils (USEPA, 1983).

2.5 HYDROGEOLOGY

2.5.1 Regional Hydrogeology

Most of the industrial and domestic water supply in the Birmingham area is provided by surface water sources. Groundwater resources in the Birmingham Valley are used to a limited degree for industry, manufacturing and ore extraction, and some municipal supply. Hydrogeologic units in the area which supply groundwater include the Conasauga Formation, the Ketona Dolomite, and the Knox Group, although younger Paleozoics are reported to be capable of producing sufficient quantities of water (Moffet and Moser, 1978).

The Conasauga Formation is a source of large quantities of water for wells and springs in some areas; however, the availability of water in the formation is not uniform because zones of increased porosity and permeability are concentrated along solution channels (Hunter and Moser, 1990). Recorded water production data reports yields up to 300 gallons per minute (gpm) for industrial wells and up to 3,400 gpm for springs in the Birmingham Valley. The well and spring (Tannehill Spring) with maximum reported yields are located approximately 3 and 26 miles, respectively, southwest of Sloss. In contrast, reported yields of wells completed in the vicinity of Tannehill Spring on the southwest edge of Jefferson County vary from having significantly more water than is normally required for one household to nonproducing (Moffet and Moser, 1978).

The porosity and permeability of the Conasauga Formation generally decreases with depth and most of the groundwater is contained within the upper 300 feet of the formation (Hunter and Moser, 1990). The water table in areas underlain by the Conasauga Formation is typically 5 to 30 ft bls.

The Ketona Dolomite may be also be a productive aquifer in areas where bedrock weathering has created secondary solution features, however, water-level and production data for this aquifer are lacking. The Copper Ridge member of the Knox Group is a productive aquifer with reported yields of 145 to 820 gpm in wells and up to 3,900 gpm in springs. Water levels in the Copper Ridge aquifer range from 20 to 75 ft bls.

There is no data regarding the vertical or horizontal hydraulic relationship between aquifers. Although the Conasauga Formation, Ketona Formation, and the Copper Ridge member of the Knob Group have been recognized as good aquifers, data regarding their aquifer characteristics in the area are lacking.

2.5.2 Facility Hydrology

The principal lithologic units underlying most of the Sloss Facility, including Land Disposal Areas SWMU 24 and SWMUs 38 and 39, are the overburden and the Conasauga Limestone (Figure 2-6). Based upon data collected during the FWI, groundwater flow in the Conasauga Formation is controlled by the occurrence and relationships between fractures, joints, and bedding of the limestone and the shale of the Conasauga Formation. Piezometer data collected during the Facility-Wide RFI indicate three potential water bearing zones occur in the Conasauga Formation: (1) the upper bedrock surface (top two to three feet) which is composed of highly weathered broken, limestone; (2) calcite filled fracture zones within the limestone ranging from approximately 40 to 140 ft bls; and (3) shaly zones below approximately 140 ft bls.

Several other hydrogeologic units underlie a small portion of the Facility on and adjacent to Sand Mountain in the Land Disposal Areas SWMU 23 area and the BTF area (Figure 2-6). On Sand Mountain, in the SWMU 23 area, water bearing zones are present in the Tuscumbia Limestone and in sandstone lenses within the Parkwood Formation (Figure 2-3).

The highest producing water bearing zones in the Conasauga Formation were encountered in the upper, weathered bedrock between 40 and 140 ft bls. Below 140 ft bls, the Conasauga Formation appears to be composed of massive beds of low permeability limestone with occasional relatively more permeable shaley zones and very few fractures. Water bearing zones below 140 ft bls for the most part have produced piezometers with low yields and slow groundwater recovery.

Although three water bearing zones exist in the Conasauga Formation, current water level data and the absence of a confining unit between zones suggests that the three zones are hydraulically connected. Additionally, water level data indicates the upper highly weathered limestone surface appears hydraulically connected to the overlying soil in many areas. Monthly water level data was collected from initiation of the FWI (August 1995) until December 1996 to assess the hydraulic connection between the shallow and deep (below 140 ft bls) Conasauga Formation. Based on an evaluation of the monthly water level data, it was determined that quarterly water level data would be adequate to assess the hydraulic connection between the shallow and deep Conasauga Formation. Quarterly water level data was collected beginning in January 1997.

During the Land Disposal Areas investigation, water levels were measured in all bedrock piezometers and monitor wells on August 17, 1997 (Table 2-2). Water level elevations in bedrock piezometers and monitor wells screened in permeable bedrock units shallower than 140 ft bls ranged from 506.02 ft amsl at P-1D to 603.90 ft amsl at MW-23 (Figure 2-9). Water level elevations in piezometers and monitor wells screened within the deep Conasauga Formation (depths greater than 140 ft bls), excluding MW-34D, ranged from 405.68 ft amsl at P-9 to 503.05 ft amsl at P-20 (Table 2-2 and Figure 2-10). The water level elevation in monitor well MW-34D is similar to water level elevations in the shallower piezometers and monitor wells.

Deep Conasauga Formation piezometers P-9, P-13D, and P-21 and monitor wells MW-26 and MW-34D bailed dry during well development and MW-26 and MW-34D also bailed dry during purging before groundwater sampling. Although monitor well MW-34D bailed dry during development, the water level in this monitor well recovered shortly after the well was developed and has a water level similar to piezometers and monitor wells set in the upper part of the Conasauga Formation. This suggests a hydraulic connection at this location between the three lithologic units described previously. Water levels in deep piezometers P-13D, P-20, and P-21, and monitor well MW-26 have recovered from 50 to 100 feet since development in August 1995 and indicate the deep zone is generally in hydraulic connection with the shallow, more permeable zone of the Conasauga Formation. Water levels in piezometer P-9, however, have not recovered since development and indicate some portions of the less permeable Conasauga Formation are not connected with the more permeable shallow zone and little to no groundwater flow may occur in these areas.

The shallow potentiometric map for August 1997 indicates that the groundwater flow direction in the upper Conasauga Formation beneath the Sloss Facility is generally to the northeast toward Five Mile Creek, a discharge area for the upper Conasauga Formation (Figure 2-9). Because of the change in topography on Sand Mountain north of Summit Street, the groundwater flow from Sand Mountain, which is a recharge area, is to the east toward the Polishing Pond. The deep potentiometric map for August 1997 indicates that the groundwater flow direction in the deep Conasauga is northeast in the Coke Manufacturing Plant area and to the south in the Land Disposal Areas (Figure 2-10).

The hydraulic conductivity in the Conasauga Formation aquifer system is variable, depending in part on the occurrence of interconnected fractures and weathered limestone zones. Values for hydraulic conductivity in the Conasauga Formation typically have an order of magnitude of 10^{-4} cm/sec (geometric mean), though values range from 7 x 10^{-2} (MW-29) to 4 x 10^{-8} cm/sec (P-4). Values for hydraulic conductivity in the Conasauga Formation in the area of the Land Disposal Areas SWMUs range from 7 x 10^{-2} (MW-29) to 4 x 10^{-8} cm/sec (MW-35) (Table 2-3).

The rate of groundwater flow in the bedrock aquifer varies locally with permeability and hydraulic gradient. In the southwestern section of the Facility, a relatively flat potentiometric surface with a hydraulic gradient of 0.010 feet per foot (ft/ft). In the central and northeastern portions of the Facility where the topography dips gently to the north, the hydraulic gradient is 0.025 ft/ft. Along the northwestern boundary of the Facility where Sand Mountain rises steeply a hydraulic gradient of 0.10 ft/ft was calculated. Groundwater flow velocities in the shallow Conasauga Formation, calculated from slug test results, hydraulic gradients, and aquifer properties generated during the FWI and Land Disposal Areas Investigation, may range from 0.07 feet per year (ft/yr) to 9,000 ft/yr.

2.6 LAND DISPOSAL AREAS (SWMUS 23, 24, 38, AND 39)

2.6.1 Biological Sludge Disposal Area (SWMU 23)

2.6.1.1 Description of History and Current Conditions

The Biological Sludge Disposal Area (SWMU 23) is located at the northwest part of the Sloss Facility on Sand Mountain (Figure 1-2). Sludge from the BTF Dewatering Machine (SWMU 20) and the Chemical Manufacturing Plant Benzenesulfonyl Chloride Wastewater Neutralization System (SWMU 34) was disposed on this two-acre site that is bounded by soil dikes. The unit began receiving waste in 1975 and received approximately 12 tons of sludge a day until April 1990 when the neutralization process which generated the sludge at SWMU 34 was discontinued. The unit continued receiving approximately 10 tons of biological sludge a day from the BTF until 1993 when all disposal in this unit was discontinued. While in operation, the unit was covered approximately once every 45 days. Currently the sludge generated at the BTF is transported to Beltona where it is used as a soil amendment in previously mined areas.

2.6.1.2 Previous Investigations

In February 1986, USEPA reportedly collected sludge samples from the BTF dewatering machine (filter press) which was the major source of sludge disposed in SWMU 23 (USEPA, 1989a). The analytical results indicated the following constituents and concentrations:

Constituent	Concentration
Arsenic	130 milligrams per kilogram (mg/kg)
Chromium	120 mg/kg
Cyanide	20 mg/kg
Lead	130 mg/kg
SVOCs	42,000,000 micrograms per kilogram (μg/kg)
VOCs	12,000 μg/kg

The RFA report recommended that a RFI should be conducted to evaluate the impact of the unit on groundwater, surface-water, soil, and air quality.

2.6.2 Blast Furnace Emission Control Sludge Waste Pile (SWMUs 24 and 39)

2.6.2.1 Description of History and Current Conditions

There are two Blast Furnace Emission Control Sludge Waste Piles located at the Sloss Facility. The piles contain dusky brown granular material that was generated during the production of pig iron from 1958 to 1979. The sludge that was produced at the Blast Furnace Plant was transported to a waste pile adjacent to SWMU 39 or the BTF (Figure 1-2). The material was formerly a listed USEPA Hazardous Waste (Code F016) because of its cyanide content but was removed from 40 Code of Federal Regulation (CFR) 261 by the November 12, 1980 Federal Register (Volume 45, No. 220).

The waste pile at SWMU 24 occupies several acres adjacent to the BTF. The material is currently being removed from SWMU 24 and being sold as product. As a result of mining the waste pile at SWMU 24, the footprint of this SWMU has increased. The waste pile at SWMU 39 is a northeast-southwest trending ridge that is adjacent to SWMU 38. Both SWMUs are partially vegetated and lack liners or runoff/runon controls.

2.6.2.2 Previous Investigations

In February 1986, the Environmental Service Division (ESD) of the USEPA collected sludge samples from SWMU 24 as part of a waste stream investigation. Analytical reports indicated that several metals and cyanide were detected. Chromium, lead, and zinc had the highest concentrations. During the site investigation, ESD reported that surface water drains off SWMU 24 and flows into SWMU 22.

2.6.3 Landfill (SWMU 38)

2.6.3.1 Description of History and Current Conditions

The Landfill is located at the north-central part of the Sloss Facility, adjacent to the Blast Furnace Waste Pile (SWMU 39). The pile is a northeast-southwest trending ridge, approximately 60 feet high, which began operation in the 1920s. Debris identified at the Landfill include concrete rubble, conveyor belts, wood, construction material, empty 55-gallon drums, flue dust, and coal. The landfill is still used for disposal of uncontaminated concrete, brick, block, and soil from excavation activities. The landfill was subjected to a metals recovery operation over the last two years.

2.6.3.2 Previous Investigations

In October 1980, an evaluation of the Landfill was conducted by the Environmental Division of the Geological Survey of Alabama. The evaluation identified the disposed material as mineral fiber slag, tar trap residue, decanter tank tar, flue dust, and construction debris. The evaluation recommended disposal practices should cease and continue at a new location.

The 1989 RFA reported that the unit was not capped and had no containment controls. The USEPA recommended that monitor wells be installed and groundwater samples should be collected to determine groundwater quality.

3.0 DESCRIPTION OF INVESTIGATIVE TASKS

3.1 SURFICIAL SOIL SAMPLING

A total of fifteen (15) surficial soil samples were collected around the perimeter of SWMU 24 at sample locations 24-SL0002 through 24-SL0016. Surficial soil sample locations at SWMU 24 are shown on Figure 3-1 and the location names and sample identification numbers area summarized in Table 3-1. The purpose of the soil sampling and analysis was to determine if site soil has been impacted by the SWMU 24 sludge. Although sixteen (16) surficial soil samples were proposed in the RFI Work Plan, the number of sampling locations was reduced based on site conditions identified during the field reconnaissance. Soil was not present at or adjacent to the proposed 24-SL0001 location, only sludge was present, therefore this sampling location was eliminated from the sampling program. Copies of the surficial soil sampling logs are included in Appendix A.1. A sample designation explanation is provided in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

Surficial soil sampling was conducted in accordance with the procedures specified in the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). Samples were collected via a stainless steel hand auger after clearing the ground surface of the sludge material. The stainless steel hand auger was advanced to one foot below the top of the soil. To prevent volatilization, samples for volatile organic analysis were immediately placed in four-ounce jars and put in a cooler containing ice. Samples collected for all other analysis were mixed in a stainless steel mixing bowl using a stainless steel spoon. The soil was scraped from the sides and rolled to the middle of the bowl and initially mixed. The sample was then quartered and each quarter was mixed individually. The quarters were recombined into the center of the bowl and mixed one final time. The sample was then spooned into four-ounce glass jars with Teflon™ lined caps. The sample containers were placed in a cooler containing ice.

Duplicates, equipment blanks and field blanks were collected according to the frequency and procedures specified in the site QAPP. Duplicate samples were collected by transferring soil from the stainless steel bowl into the duplicate and field sample containers in equal portions until the containers were full. The duplicate samples collected at SWMU 24 are presented in Table 3-1. The sampling equipment was decontaminated in accordance with the site-specific QAPP.

The soil samples were preserved with ice and relinquished either to a courier for delivery or delivered by G&M sampling personnel to Analytical Services Incorporated (ASI). Soil samples were analyzed for USEPA Method 8270B (SVOCs) and USEPA Method 8260A (VOCs), the thirteen PP metals, barium, and cyanide. Analytical reports for the soil samples are presented in Volume III, Analytical Data, of the RFI Land Disposal Areas Report. After completion of the sampling and analysis program, the field and analytical data were reviewed and validated according to procedures outlined in the site QAPP. The checklists completed during the data validation are included in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

3.2 SLUDGE SAMPLING

Sludge samples from SWMUs 23, 24, and 39 were collected from June 16 to 19, 1997. The sludge sample location names and sample identification numbers are summarized on Table 3-2. Sludge samples were collected at four (4) locations at SWMU 23 (23-SM0001 through 23-SM0004) and at SWMU 24 (24-SM0001 through 24-SM0004). The sludge sample locations for SWMUs 23 and 24 are shown on Figures 3-2 and 3-1, respectively. Sludge samples were collected at six (6) locations (39-SM0001 through 39-SM0006) at SWMU 39. However, as specified in the work plan, only four of the sludge samples collected from SWMU 39 were analyzed by ASI. The locations of the four sludge samples (39-SM0002, 39-SM0003, 39-SM0005, and 39-SM0006) analyzed by ASI are shown on Figure 3-3. Copies of the sludge sampling logs are included in

Appendix A.2. A sample designation explanation is provided in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

Sludge sampling was conducted in accordance with the procedures specified in the FSP and QAPP. Samples were collected by scooping sludge from select areas of the waste piles using a stainless steel spoon after removing weathered material at surface. To prevent volatilization, samples for volatile organic analysis were immediately placed in four-ounce jars and put in a cooler containing ice. Samples collected for all other analysis were mixed in a stainless steel mixing bowl using a stainless steel spoon. Sample mixing followed procedures discussed in Section 3.1. The sample was then spooned into four-ounce and one-liter, wide-mouth glass jars with Teflon™ lined caps. The sample containers were placed in a cooler containing ice.

Duplicates, equipment blanks and field blanks were collected according to the frequency and procedures specified in the site QAPP. Duplicate samples were collected by transferring sludge from the stainless steel bowl into the duplicate and field sample containers in equal portions until the containers were full. The duplicate samples collected are presented in Table 3-2. The sampling equipment was decontaminated in accordance with the site-specific QAPP.

The sludge samples were preserved with ice and relinquished either to a courier for delivery or delivered by G&M sampling personnel to ASI. Sludge samples were analyzed for USEPA Method 8270B (SVOCs) and USEPA Method 8260A (VOCs), the thirteen PP metals, barium, cyanide, and Toxicity Characteristic Leaching Procedure (TCLP) constituents. Analytical reports for the sludge samples are presented in Volume III, Analytical Data, of the RFI Land Disposal Areas Report. After completion of the sampling and analysis program, the field and analytical data were reviewed and validated according to procedures outlined in the site QAPP. The checklists completed during the data validation are included in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

3.3 GEOPHYSICAL INVESTIGATION

The RFI Work Plan proposed collection of seismic and terrain conductivity surveys data around the SWMU 23 and SWMUs 38 and 39; however, changes to the geophysical survey were proposed in a letter to the USEPA dated May 12, 1997. Proposed changes included elimination of the seismic survey during the Land Disposal Areas investigation because seismic survey and geologic mapping data generated during the FWI provided adequate bedrock topography data. Seismic data collected during the FWI pertinent to SWMU 23 and SWMUs 38 and 39 are presented in this report.

The letter also proposed that grounded resistivity measurements be taken on the western side of SWMUs 38 and 39 to minimize the effect of the railroad tracks and cars on the results. During the field investigation, additional changes based on field conditions included collection of EM-31 data around SWMU 23 and SWMUs 38 and 39 to provide geophysical data to 18 ft bls and collection of ground resistivity data around SWMUs 38 and 39 to minimize the effect of buried and overhead powerlines and overhead and buried pipelines. Proper electrode spacing for ground resistivity readings were determined in the field by the Senior Field Geophysicist using two Schlumberger soundings.

3.3.1 Perimeter Conductivity and Resistivity Surveys

Perimeter conductivity and/or resistivity surveys around SWMU 23 and SWMUs 38 and 39 were conducted from July 7 to July 14, 1997 at the Sloss Facility to locate anomalous areas of relatively high conductivities in soil and groundwater. Geophysical and geologic data were used to determine if anomalous conductive regions were derived from landfill materials (*i.e.* leachate). EM-31 and EM-34 readings were collected around SWMU 23 at 5 and 25 foot spacings, respectively, and the geophysical investigation line is shown on Figure 3-2. EM-31 and ground resistivity readings were collected around SWMUs 38 and 39 at 5 and 25 foot spacings, respectively, and the geophysical investigation line is shown on Figure 3-3.

Labeled pin flags were placed along the geophysical investigation lines. These lines were later surveyed and the coordinates used to present the conductivity and resistivity data. The conductivity and resistivity data interpretation process are discussed in Appendix B.

3.3.2 Seismic Survey

A perimeter seismic survey was conducted around the Sloss Facility from June 5 to June 20, 1995 during the FWI to provide a preliminary identification of the bedrock surface and to develop a conceptual hydrogeologic model. A total of 47 seismic spreads were placed around the perimeter of the Sloss Facility at the locations presented in Figure 3-4. Seismic data was collected along the eastern boundary of SWMU 23 (seismic lines S40 and S41) and along the eastern and western boundary of SWMUs 38 and 39 (seismic lines S5, S6, S26 though S29, S34, and S35).

A Strata View™ 48 channel seismic recorder manufactured by Geometrics of California was used for the survey. Vertical component geophones with a natural frequency of 40 hertz (Hz) were used to sense seismic vibrations. The spacing between the geophones was 5 feet, giving a spread length of 235 feet. This spread length did not allow for continuous site coverage of the Sloss Facility perimeter which was proposed in the RFI Work Plan; however, it was the Senior Field Geophysicist's assessment that the new density of data would provide a good statistical evaluation of the bedrock topography of the site.

A 15 pound sledge hammer was used as an energy source by hitting a metal base plate placed on the ground surface. By stacking the results from several hammer blows on the base plate at each shot location, this setup produced good quality seismic data.

Shots were placed at the ends of the seismic spread along with three shots placed approximately equally spaced within the spread. On some of the spreads, shots were also placed 50 feet beyond the ends of the spread. However, in all cases, depths and velocities are interpreted only from within the spread length.

At each of the shot locations a labeled pin flag was placed. These shot points were later surveyed and the coordinates used to present the seismic data. Further details on the seismic survey and data interpretation process are discussed in Section 2.7 and Appendix E of the RFI Facility-Wide Report.

3.4 SUBSURFACE SOIL SAMPLING

Subsurface soil samples were collected at Land Disposal Areas SWMU 23 and SWMUs 38 and 39 at the locations of the monitor wells. Soil samples were collected during installation of new monitor wells MW-21, MW-29, MW-33, MW-35, MW-37 in August 1997. Chemical analysis was not performed on soils from monitor well MW-31 because soil was not present above the bedrock surface.

As proposed in a letter to USEPA dated May 12, 1997, several piezometers installed during the FWI, which coincided with proposed monitor well locations for SWMU 23 and SWMUs 38 and 39, were converted to monitor wells (Table 2-2). The FWI piezometers were constructed in accordance with the monitor well specifications presented in the RFI Work Plan. At monitor wells MW-22 through MW-28, MW-30, MW-32, MW-34, and MW-36 soil borings were drilled adjacent to the existing monitor wells to collect subsurface soil samples (Table 3-3). Lithologic data collected during installation of these monitor wells in 1995 was used to select the subsurface sample intervals for laboratory analysis. Chemical analysis was not performed on soils from the soil boring adjacent to MW-32 because soil was not present above the bedrock surface.

A total of 29 soil samples were collected at 15 monitor well locations for chemical analysis (Table 3-3). Sample collection and laboratory analyses were conducted in accordance with the procedures and methods described in the site FSP and QAPP. The soil samples were field screened to determine the concentration of volatile organic vapors, using an Organic Vapor Monitor (OVM) equipped with a Photo Ionization Detector (PID). A sample designation explanation is provided in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

Detailed soil sample logs were prepared for each subsurface soil sample using the Unified Soil Classification System (USCS). Copies of the subsurface soil sampling logs are presented in Appendix A.3. The drilling and sampling equipment were decontaminated in accordance with the site QAPP.

Subsurface soil samples were collected using a truck mounted hollow stem auger drill rig. Continuous formation samples were collected from boreholes for monitor wells MW-21, MW-29, MW-31, MW-33, MW-35, MW-37 at 2-foot intervals using split spoon samplers in accordance with American Society Testing Materials (ASTM) Method D-1586. At the locations where piezometers were converted to monitor wells, soil borings were drilled adjacent to the existing monitor wells and the split spoon sampling intervals were selected using depth requirements specified in the RFI Work Plan and existing lithologic data. The standard split spoon used was two inches in diameter and two feet in length, providing a discrete sample of the two-foot interval. The split spoon was attached to the end of the drilling rod and driven into the soil the length of the sampler. After reaching the desired depth, the split spoon was withdrawn from the borehole, detached from the drilling rod, and opened. The upper portion of the split spoon was discarded.

At each borehole, subsurface samples were collected for chemical analysis in the middle of the soil column (1/2 the distance between the surface and the top of bedrock) and just above the top of bedrock surface. In some boreholes, fill or sludge materials comprised a significant portion of the material above the top of bedrock surface and soil samples for chemical analyses were not collected from one or both of the proposed collection depths. If the soil thickness was less than five feet, one sample was collected just above the bedrock surface. Similarly, if the soil thickness was less than one-half foot, soil samples for chemical analyses were not collected due to the inability to acquire sufficient sample volume using the split spoon sampler (MW-31 and MW-32).

To prevent volatilization, soil from each sample interval was collected for VOC analysis by transferring the soil directly from the sampling instrument to the appropriate sample container immediately after the split spoon was opened. The VOC samples were then placed in a cooler with ice. The remaining soil was mixed for semivolatile and metals analysis. Sample mixing followed procedures discussed in Section 3.1. After the mixing was complete, the sample was then spooned into wide-mouth glass jars with Teflon™ lined caps.

Some of the soil samples had a high clay content. In clayey soils, mixing the samples according to the standard procedures was not possible. In these cases, the sample was placed in the bowl and finely subdivided with a stainless-steel spoon. Representative portions of the subdivided sample were then distributed to appropriate sample containers.

Duplicates, equipment blanks and field blanks were collected according to the frequency and procedures specified in the site QAPP. Duplicate soil samples for semivolatile and metals analysis were collected by transferring soil from the stainless steel bowl into the appropriate containers in equal portions until the containers were full. In clayey soils, each duplicate container was filled with equally representative soil portions. Duplicate samples collected are presented in Table 3-3.

Soil samples were preserved with ice and relinquished to a courier for overnight delivery service to ASI in Atlanta, Georgia for USEPA Method 8260A (VOCs), USEPA Method 8270B (SVOCs), the thirteen PP metals, barium, and cyanide analysis.

Drill cuttings generated at SWMUs 23, 38 and 39 soil sample locations were containerized in Department of Transportation (DOT)-approved 55 gallon drums, labeled, and stored in a central staging area. Soil results were used to characterize investigation derived waste (IDW) soil, except at MW-31 and MW-32 where soil samples were not collected. At these locations, samples of drummed soil cuttings were collected and analyzed for USEPA Method 8260A, USEPA Method 8270B, PP metals, barium, and cyanide. Characterization of the IDW soil and disposal recommendations are presented in Volume II, Investigation Derived Waste Report, of the Land Disposal Areas RFI Report. Boreholes which were not converted to monitor wells, were abandoned by filling the bore hole with a 3% bentonite mixture neat cement grout.

Analytical reports for the soil samples and IDW samples are presented in Volume III, Analytical Data, of the RFI Land Disposal Areas Report. After completion of the sampling and analysis program, the field and analytical data were reviewed and validated according to the procedures outlined in the site QAPP. The checklists completed during the data validation are included in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

The intervals sampled at each location, and the methodology used to select the sample intervals is discussed below in SWMU specific sections.

3.4.1 SWMU 23

Subsurface soil samples were collected from the five monitor well locations at SWMU 23 (Table 3-3, Figure 3-2). Soil samples were collected at the location of newly installed monitor well MW-21 and previously installed monitor wells MW-22, MW-23, MW-24 and MW-25S/MW-25D. The proposed locations of monitor wells MW-22, MW-23, MW-24, and MW-25S/MW25D coincided with FWI piezometers P-31, P-30, P-29, and P-28S/P-28D, respectively, and these piezometers have been converted into monitor wells. Soil borings 23-SBMW22, 23-SBMW23, 23-SBMW24, and 23-SBMW25, respectively, were drilled adjacent to the existing monitor wells to collect subsurface soil samples (Table 3-3).

Subsurface soil samples were collected at mid-depth and just above the bedrock surface at the borehole for monitor well MW-21 and from soil borings 23-SBMW23 and 23-SBMW24. The location names, sample identification numbers, and sample intervals for the subsurface soil samples are presented in Table 3-3. Only one subsurface soil sample, 970806-LD-23-SL00022 (0-2), was collected from a soil boring 23-SBMW22 since the bedrock surface was observed at 2 ft bls during installation of this well. A single soil sample, 970805-LD-23-SL0025 (19-21), was collected just above the bedrock surface in soil boring 23-SBMW25 due to the presence of a significant thickness of sludge and lime used for stabilization of biological sludge at this location.

3.4.2 SWMUs 38 and 39

Subsurface soil samples were collected from ten of the 12 monitor well locations at SWMUs 38 and 39 (Figure 3-3). In the vicinity of SWMU 38, soil samples were collected from six monitor well locations. Soil samples were collected at the location of newly installed monitor wells MW-29 and MW-37 and previously installed monitor wells MW-26, MW-27, MW-28, and MW-30S/MW-30D. Soil samples could not be collected at newly installed monitor well MW-31 since less than one-half foot of native soil was present at this location. The proposed locations of monitor wells MW-26, MW-27, MW-28, and MW-30S/MW30D coincided with the locations of FWI piezometers P-27, P-26, P-25, and P-24S/P-24D, respectively, and these piezometers have been converted into monitor wells (Table 2-2). Soil borings 38-SBMW26, 38-SBMW27, 38-SBMW28, and 38-SBMW30, respectively, were drilled adjacent to the existing monitor wells to collect subsurface soil samples (Table 3-3).

Subsurface soil samples were collected at mid-depth and just above the bedrock surface from the boreholes for newly installed monitor wells MW-29 and MW-37 and from soil borings 38-SBMW26, 38-SBMW27, 38-SBMW28, and 38-SBMW30. The location names, sample identification numbers, and sample intervals for the subsurface soil samples are presented in Table 3-3. Soil sample 970808-LD-38-SL0027 (22-24) was collected from a second borehole installed adjacent to monitor well MW-27 to replace the 970805-LD-38-SL-0027 (22-24) VOC sample which was broken during shipment.

In the SWMU 39 area, subsurface soil samples were collected from four locations (Table 3-3, Figure 3-2). Soil samples were collected at the location of newly installed monitor wells MW-33 and MW-35 and previously installed monitor wells MW-34S/MW-34D and MW-36. Since soil was not present above the bedrock surface at previously installed monitor wells MW-32, soil samples were not collected. The proposed locations of monitor wells MW-32, MW-34S/MW-34D, and MW-36 coincided with the locations of FWI piezometers P-7, P-6S/P-6D, and P-5, respectively, and these piezometers have been converted into monitor wells (Table 2-2). Soil borings 39-SBMW32, 39-SBMW34 and 39-SBMW36 were installed adjacent to these monitor wells to collect the subsurface soil data.

Only one soil sample was collected from the boreholes for monitor wells MW-33 and MW-35 and from soil boring 39-SBMW34 since less than 5 feet of native soil material was present above the bedrock surface at each location. Subsurface soil samples were collected at mid-depth and just above the bedrock surface from soil boring 39-SBMW36. The location names, sample identification numbers, and sample intervals for the subsurface soil samples are presented in Table 3-3. Soil sample 9708008-LD-39-SL0034 (10-12) was collected from a second borehole installed between existing monitor wells MW-34S and MW-34D for collection of soil samples to replace the 970805-LD-38-SL-0034 (10-12) VOC sample which was broken during shipment.

3.5 MONITOR WELL INSTALLATION

At SWMU 23, the approved RFI Work Plan indicated a total of 8 monitor wells would be installed; however, six monitor wells were installed. Since five of the proposed monitor well locations coincided with FWI piezometer locations and the piezometers were constructed in accordance with monitor well construction specifications detailed in the work plan, these five piezometers are being utilized as monitor wells. At SWMU 23, piezometers P-28S, P-28D, P-29, P-30, and P-31 were converted to monitor wells MW-25S, MW-25D, MW-24, MW-23, and MW-22, respectively. New monitor well MW-21 was installed in 1997 during the Land Disposal Areas RFI. Proposed monitor well MW-20 was not installed because SWMU 23 does not extend as far down Sand Mountain as originally depicted in the work plan. Additionally, the proposed deep monitor well at the MW-23 location was eliminated because a deeper monitor well was not warranted since MW-23 is 78.5 ft deep. These modifications to the scope of work were proposed in a letter dated May 12, 1997 to the USEPA.

At SWMUs 38 and 39, the approved RFI Work Plan indicated a total of 12 monitor wells would be installed; however, 14 wells were installed. Since seven of the proposed monitor well locations coincided with FWI piezometer locations and the piezometers were constructed in accordance with monitor well construction specifications detailed in the work plan, these seven piezometers are being utilized as monitor wells. At SWMUs 38 and 39, piezometers P-5, P-6S, P-6D, P-7, P-27, P-26, P-25, P-24S, and P-24D were converted to monitor wells MW-36, MW-34S, MW-34D, MW-32, MW-26, MW-27, MW-28, MW-30S, and MW-30D, respectively (Table 2-2). Although monitor well couplets were not proposed in the work plan at MW-34 and MW-30, piezometer couplets had been installed at these locations during the FWI and the deeper wells (MW-34D and MW-30D) in the couplet are being utilized in the SWMUs 38 and 39 investigation. Five new shallow bedrock monitor wells MW-29, MW-31, MW-33, MW-35, and MW-37 were installed during the 1997 Land Disposal Areas investigation.

3.5.1 Installation Methods

The monitor wells which were installed during the Land Disposal Areas RFI and monitor wells, which were initially installed as FWI piezometers were installed in the first water bearing zone encountered during drilling. Information from the monitor wells will assist in characterizing the site geology, hydraulic gradients, groundwater flow rates, flow direction, and groundwater quality in the Land Disposal Areas SWMUs. Construction details for the monitor wells in the Land Disposal Areas are included in Table 2-2. Both the monitor wells which were installed during the Land Disposal Areas RFI and monitor wells, which were initially installed as FWI piezometers were installed using the following procedures.

Two drill rigs and two different methods of drilling were utilized to drill the boreholes for the monitor wells. First, a hollow stem auger drill rig was used for drilling in the unconsolidated residuum and collecting split spoon samples. After the auger rig encountered bedrock or auger refusal, down-hole percussion hammer drilling was used to complete the monitor well borehole in bedrock. A decontamination pad for decontamination of drilling equipment was constructed using visquene on a bermed, concrete pad near the Chemical Manufacturing Plant. All drilling and sampling equipment was decontaminated in accordance with the QAPP.

The hollow stem auger drill rig, using 3.25 inner diameter (I.D.) augers, was used to drill a nominal 7.25-inch pilot hole through the overburden sediments to auger refusal. At the monitor well locations, 2-foot split spoon formation samples were collected continuously from the land surface to the top of bedrock. The split spoon sampling was performed in accordance with ASTM Method D-1586. After the split spoon was opened, the samples were field screened to determine the concentration of volatile organic vapors, using an OVM equipped with a PID. The physical characteristics of the samples obtained were described in detailed soil boring logs using the USCS. Copies of the soil boring logs for the newly installed and the monitor wells installed during the FWI are provided in Appendix A.4. After the soil was characterized, soil samples were archived in labeled, airtight glass containers.

During the hollow stem auger drilling, the subsurface conditions at each location were evaluated to determine if a surface casing was needed. If a possible source of contamination was suspected to be near the monitor well, a 6-inch diameter steel surface casing was installed through the overburden into the bedrock surface. If a surface casing was required, the existing 7.25-inch borehole was reamed to be a nominal 10-inch diameter borehole using the air rotary method of drilling. Air was used as the circulating media during drilling to clear the borehole of cuttings. The air from the compressor on the rig was filtered using in-line and external filters to prevent oil from the compressor from being introduced into the borehole. A small volume of potable water was occasionally used during drilling to assist in the removal of drill cuttings. The borehole was advanced approximately two feet into the bedrock surface, however, if the bedrock surface was highly fractured or weathered, the borehole was advanced until more competent rock was encountered.

After removal of the drill bit, a 6-inch steel surface casing was installed to the total depth of the borehole. Permanent 6-inch surface casing was installed at monitor wells MW-31, MW-33, MW-35, and MW-37 installed during the Land Disposal Areas investigation and MW-25S, MW-25D, MW-26, MW-27, MW-32, MW-34S, and MW-34D and MW-36 installed during the FWI. The annular space was then sealed with neat cement grout by pressure grouting with a tremie pipe from the bottom of the hole to land surface. The cement grout consisted of a mixture of Portland Type I cement (ASTM Method C-150) and water in a proportion that did not exceed seven gallons of potable water per bag of cement (94 pounds). Additionally, 3 percent by weight of bentonite was added to the grout to prevent shrinking and to control the heat of hydration during grouting.

If there were no adjacent sources of possible contamination, but the overburden was unstable allowing for possible cave-in during drilling, a temporary 6-inch steel surface casing was installed. A nominal 9-inch borehole was advanced through the overburden using the air rotary method of drilling. The borehole was drilled approximately 2 feet into the bedrock surface, or until competent bedrock was encountered. After the drill bit was removed, a 6-inch steel surface casing was installed to the total depth of the borehole. A bentonite seal, approximately 2- to 3-feet thick, was placed around the bottom of the surface casing where it was seated in the bedrock. The annular space at the land surface was sealed off with visquene to prevent rock cuttings from falling into the annular space during drilling. The remaining annular space was left open. A temporary surface casing was installed at monitor well MW-29 during the Land Disposal Areas investigation and MW-24S, MW-24D, and MW-28 during the FWI. Following completion of the well, the temporary surface casing was removed.

After allowing the surface casing grout to set or bentonite in the case of a temporary surface casing, a nominal 6-inch diameter borehole was drilled inside the surface casing by down-hole percussion hammer drilling. Air was used as the circulating media during drilling to clear the borehole of cuttings. The screened intervals of the monitor wells were selected so that completed monitor wells would provide representative hydrologic information for the water bearing zone. The boreholes were advanced in bedrock until the drill cuttings were damp or wet and the borehole appeared to produce sufficient water for a monitor well.

The bedrock monitor wells were constructed using 10 feet of new, 2-inch-diameter, factory slotted, 0.010-inch slot polyvinyl chloride (PVC) screen with schedule 40, threaded, flush joint, PVC casing extending to land surface. A schematic diagram of a typical bedrock monitor well is shown in Figure 3-5. The PVC casings conformed to the requirements of ASTM Method D-1785 and carried the seal of the National Sanitation Foundation. A section of closed end, schedule 40 PVC casing was attached to the bottom of each screen to provide a sump for sediments. Each monitor well was fitted with a vented PVC cap.

The annular space between the borehole and the screen was filled with 20/30 graded silica sand from the bottom of the borehole to approximately 2 feet above the top of the well screen, either by gravity feeding the sand from the surface, or by using the tremie method.

A nominal 2-foot thick bentonite seal was placed above the filter pack in each piezometer to prevent the downward migration of cement grout. The seal, consisting of tamped bentonite pellets, was installed by gravity feeding from the surface and allowed to hydrate for a minimum of one hour. The remaining annular space above the bentonite was sealed by pressure grouting with neat cement grout through a tremie pipe to land surface. The cement grout consisted of a mixture of Portland Type I cement (ASTM Method C-150) and water in a proportion that did not exceed seven gallons of clean water per bag of cement (94 pound). Additionally, 3 percent by weight of bentonite powder was added to the grout to prevent shrinking and control the heat of hydration during grouting.

The boreholes were drilled as near to plumb as possible to assist in proper casing alignment, and placement of the sand pack and cement seal. The plumbness of each monitor well was checked by running a 6 ft length of 1.75-inch outer diameter (O.D.) PVC attached to clean polyethylene rope to the bottom of the monitor well. Monitor well casing plumbness was checked before and after grouting the annular space.

Drill cuttings from each borehole were containerized in DOT-approved 55-gallon drums and labeled with the well number, date, and site. In August 1997, IDW rock cuttings from monitor wells installed during the Land Disposal Areas investigation were sampled and analyzed for USEPA Method 8260A, USEPA Method 8270B, the thirteen PP metals, barium, and cyanide. Analytical reports for the IDW samples and the checklists completed during the data validation are presented in Volume III, Analytical Data, of the RFI Land Disposal Areas Report. Characterization of the IDW and recommendations for disposal are presented in Volume II, Investigation Derived Waste Report, of the RFI Land Disposal Areas Report. IDW drill cuttings from the monitor wells installed during the FWI were characterized in the RFI Facility-Wide Report.

Precautions were used during the drilling and monitor well construction to prevent the entry of foreign material into the well. Monitor well casings were set to extend to two to three ft above grade, and surrounded by a 4-inch diameter protective steel casing set into a concrete pad. The protective steel casings have locking caps. Each concrete pad has nominal dimensions of 3 ft x 3 ft x 4-inches and slopes away from the monitor well. A permanent metal plate was installed in each concrete pad and stamped with the monitor well identification number. In areas where monitor wells could possibly be damaged by vehicular traffic, 4-inch diameter steel protective posts were placed equally spaced around the monitor well. The number of protective posts used ranged from two to four posts. At one location (MW-33), six 6-inch steel posts were installed around the monitor well due to a high probability of the monitor well being damaged by heavy machinery. When installed, the protective posts were concreted into the ground to a depth of approximately two ft bls, and then the posts were filled with concrete.

The Geraghty & Miller representative prepared detailed monitor well construction and sample core logs for each monitor well. Copies of the field logs for the monitor wells installed during the Land Disposal Areas investigation and the FWI are included in Appendix A.5.

3.5.2 Well Development

After completion of each monitor well, but no sooner than 48 hours after grouting was completed, monitor well development was conducted. The monitor wells were developed by pumping and/or bailing. No acids or dispersing agents were used in any monitor well. Development continued until the pH, conductivity, and turbidity of the groundwater had stabilized, or until it was determined that further development would not provide any significant improvement in turbidity. The well yield for monitor wells MW-26, MW-34D, and MW-35, were too low to permit continuous pumping or bailing. This monitor well was initially pumped dry and allowed to recharge for 24 hours. After 24 hours, the volume of water in the monitor well casing was considered one recharge volume and the monitor well was repeatedly bailed dry until five recharge volumes were removed. Monitor well development logs are presented in Appendix A.6.

Development water was containerized in DOT-approved 55-gallon drums and labeled with the monitor well identification number, site location and date. Groundwater sampling results will be used to characterize IDW development water. Characterization of the IDW development water and disposal recommendations are presented in Volume II, Investigation Derived Waste Report, of the RFI Land Disposal Areas Report.

3.6 IN-SITU PERMEABILITY TESTING

In-situ permeability tests were performed on each of the installed monitor wells to determine the hydraulic conductivity of the formation around the screened portion of each well. In-situ permeability tests were conducted on the monitor wells installed during the Land Disposal Areas investigation in August 1997 and the monitor wells installed during the FWI in August 1995. The tests were performed by rapidly lowering a sealed, closed end, water filled PVC pipe (slug) into each monitor well, instantaneously displacing the water column from its initial static level. The water level in each monitor well was measured to 0.01-foot accuracy with a pressure transducer and an In-Situ Model SE 1000B Hermit data logger. The initial phase of the test is known as a falling head slug test. After the water level had equilibrated, less than 0.01 ft change over at least six minutes, the slug was quickly removed causing the water column to instantly fall and then begin to rise towards its static level. The falling head and rising head versus time data were analyzed to determine the hydraulic conductivity at each monitor well tests.

The accumulated data were transferred to an IBM Compatible PC from the data logger. Microsoft Excel™ software was used to organize, print, and graph the raw data.

The hydraulic conductivity was calculated using ARCADIS Geraghty & Miller, Inc. AQTESOLV™ software which solves for hydraulic conductivity using the method presented by Bouwer and Rice (1976). In general, data from the water-level displacement during the initial phase of infiltration and recovery were given a higher weight due to minimal sandpack effects, and the best-fit line was found for data points from the beginning of the test which represent steady-state recovery. Monitor well slug test logs and evaluations are presented in Appendix C for the new and previously installed monitor wells.

3.7 WATER LEVEL MEASUREMENTS

Water level measurements were collected on August 17, 1997 at all site piezometer locations and monitor wells in the Land Disposal Areas SWMUs using an electronic water rule (Appendix A.7). Table 2-2 summarizes water level data collected in August 1997. Additionally, surface water levels were measured at the staff gages in Five Mile Creek and the drainage ditch in August. The water level at staff gage SG-3 was not measured because it could not be located on August 17, 1997. The data obtained on August 17, 1997 was used to construct groundwater contour maps which were used to estimate flow patterns and gradients over the site. The electronic water rule was decontaminated prior to use at each piezometer and monitor well according to the procedures specified in the site QAPP.

3.8 GROUNDWATER SAMPLING

A total of twenty (20) monitor wells (MW-21 through MW-37) were sampled at SWMUs 23, 38, and 39. The purpose of the groundwater sampling and analysis was to determine if groundwater has been impacted by site activities. Copies of the groundwater sampling logs are included in Appendix A.8. A sample designation explanation is provided in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

Groundwater sampling was conducted in accordance with the procedures specified in the FSP and QAPP which are summarized below. After taking water level and total depth measurements using an electronic water rule at each well, the volume of water in the wells and the purge volume were calculated. The well was purged using a 2-inch submersible pump with the pump intake approximately 10 feet into the water column. As drawdown increased, the pump was lowered to prevent exposure of the intake. In this manner, stagnant water was removed from the well casing from the top to the bottom. If no appreciable drawdown was observed, the pump was not lowered and fresh formation water was allowed to be drawn up the casing to the intake point by the pump.

The 2-inch submersible pump is equipped with a check valve which prevents purged water in the discharge hose from draining out of the pump during removal of the pump from the well or while the pump is shut off. Pumping rates of one gallon per minute or less were used to purge wells to minimize the amount of sediment entrained in the water column induced by purging activities.

Three to five well volumes were purged from each monitor well using the 2-inch submersible pump unless the well went dry. Monitor wells MW-26, MW-34D, and MW-35 pumped dry after approximately one well volume and were sampled less than 24 hours later after they had recovered enough to collect the required samples. Less than 5 well volumes were purged only when pH, conductivity, temperature, dissolved oxygen, and turbidity readings stabilized in less than 5 well volumes.

Field parameters (pH, conductivity, temperature, dissolved oxygen, and turbidity) were measured during purging and immediately before collecting groundwater samples from each monitor wells sampled (Table 3-4). Field instruments were calibrated according to the frequency and procedures specified in the site QAPP.

After 5 well volumes had been purged or field parameters stabilized groundwater samples were collected through the 2-inch submersible pump for USEPA Method 8270B (SVOCs), the thirteen PP metals, barium, and cyanide. After non-volatile samples had been collected, the 2-inch submersible pump was removed from the well. Groundwater samples for USEPA Method 8260A (VOCs) were collected from the center of the screened interval using a Teflon™ bailer attached to a Teflon™ coated stainless steel. The VOC samples were collected using the procedures detailed in the site QAPP to minimize aeration of the sample.

Monitor wells that pumped dry (MW-26, MW-34D, and MW-35) were sampled for USEPA Method 8260A, USEPA Method 8270B, the thirteen PP metals, barium, and cyanide from the center of the screened interval using a Teflon™ bailer attached to a Teflon™ coated stainless steel cable. Groundwater samples for USEPA Method 8260A were collected first using the procedures detailed in the site QAPP to minimize aeration of the sample. Samples for USEPA Method 8270B, the thirteen PP metals, barium, and cyanide were collected using the Teflon™ bailer after collection of the USEPA Method 8260A samples.

After collection, sample containers were placed in a cooler containing ice. Duplicate samples were collected by filling containers with equal aliquots of groundwater. Equipment blank, field blank, and duplicate samples were collected according to the frequency and procedures specified in the site QAPP. All sampling equipment was decontaminated in accordance with the QAPP.

The groundwater samples were preserved with ice and relinquished to a courier for delivery to ASI. Analytical reports for the groundwater samples are presented in Volume III, Analytical Data, of the RFI Land Disposal Areas Report. After completion of the sampling and analysis program, the field and analytical data were reviewed and validated according to procedures outlined in the site QAPP. The checklists completed during the data validation are included in Volume III, Analytical Data, of the RFI Land Disposal Areas Report.

Purge water was containerized in DOT-approved 55-gallon drums and labeled with the monitor well identification number, site location, and date. If development water drums at each monitor well location were not completely filled, purge water generated during the groundwater sampling event was placed in the development water drums. Purge water from different monitor wells was not mixed. Groundwater sampling results were used to characterize the IDW purge water. Characterization of the IDW purge water and disposal recommendations are presented in Volume II, Investigation Derived Waste Report, of the RFI Land Disposal Areas Report.

3.9 SITE SURVEY

Abrams Aerial Survey Corporation prepared a site topographic map for the Sloss Industries Corporation Facility during preparation of the RFI Work Plan. During the FWI, information was obtained from Abrams Aerial Survey Corporation on the survey control used during preparation of the base map so that the site surveys for all RFIs could be tied to the existing site map. This site map was used as the base map for the Land Disposal Areas investigation. All surveying completed for the Land Disposal Areas investigation was conducted by a State-certified land surveyor.

In June to August 1997, surficial soil and sludge sample locations, geophysical survey lines, and newly installed monitor well locations were surveyed vertically to mean sea level and tied horizontally to the site base map. Land Disposal Areas survey data is presented in Appendix D and surface elevations for the monitor wells are presented on Table 2-2.

4.0 DESCRIPTION OF INVESTIGATIVE TASKS

During the Land Disposal Areas Investigation, several investigative approaches were utilized in evaluating whether a release had occurred in the past. A geophysical conductivity and/or resistivity survey of the perimeter of SWMU 23 and SWMUs 38 and 39 was performed to locate areas with relatively high conductivities in soil and groundwater which may be a result of migration of contaminants from the SWMUs as leachate. Seismic data collected during the FWI around the perimeter of SWMU 23 and SWMUs 38 and 39 was used to provide data on the depth to bedrock.

The chemical properties of the sludge associated with the Land Disposal Areas SWMUs were investigated to evaluate the potential contaminants present in the sludge. The chemical properties of the surficial and/or subsurface soils and groundwater were investigated to confirm the presence or absence of contamination at these SWMUs. Sludge, surficial and/or subsurface soils, and groundwater samples were analyzed for VOCs (USEPA Method 8260A), SVOCs (USEPA Method 8270B), the thirteen PP metals, barium, and cyanide. Sludge samples were also analyzed for TCLP constituents.

Total VOCs, SVOCs, PP metals, barium, and cyanide data were collected to assess the chemical properties of the sludge samples. The sludge samples were evaluated based on comparison of the TCLP results to RCRA Toxicity Characteristic (TC) levels to assess the potential for chemical constituents present in the sludge to leach into the soil and groundwater.

Soil concentrations were evaluated based upon a comparison to USEPA Region III RBCs for soil ingestion in a residential setting as presented in the Region III USEPA Risk-Based Concentration Table dated April 13, 2000 (Table 4-1). In accordance with risk assessment guidelines, the residential RBCs for soil ingestion were used as a screening tool to identify if a potential risk exists. A risk assessment was then conducted to evaluate actual risk which may exist. RBCs are chemical concentrations corresponding to fixed levels of risk (i.e., hazard quotient of 1, or a lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration). The RBCs were developed by taking toxicity constants (reference doses and carcinogenic potency slopes) and combining these constants with "standard" exposure scenarios. Residential RBCs for soil ingestion were not available for several compounds detected including acenaphthylene, benzo(g,h,i)perylene, and phenanthrene (Table 4-1).

Groundwater concentrations were evaluated based upon a comparison to USEPA Maximum Contaminant Levels (MCLs) or Region III RBCs for tap water if an MCL was not available for a constituent. The MCLs or RBCs for tap water were used as a screening tool to identify if a potential risk exists. A risk assessment was then conducted to evaluate actual risk which may exist

Based upon a review of data collected at Land Disposal Areas SWMUs, concentrations of metals detected were below USEPA Residential RBCs except for arsenic. Because concentrations of arsenic are naturally high in site soils, site background soil results for arsenic were used during the data evaluation (Tables 2-1 and 4-1).

4.1 BIOLOGICAL SLUDGE DISPOSAL AREA (SWMU 23)

4.1.1 Site Specific Geology

SWMU 23 is located on Sand Mountain on the fault slice mapped during the FWI. The fault slice is located between the hanging wall and the footwall of the Opossum Valley Fault. The geology and structural features discussed below are depicted on Figures 2-6 and 4-1. From the base of Sand Mountain to the crest, the Mississippian age Hartselle Sandstone and Tuscumbia Limestone, Silurian age Red Mountain Formation, Mississippian age Fort Payne Chert, and the Pennsylvanian age Pottsville Formation are exposed at the surface, or interpreted to be present although they are covered (Figures 2-6 and 4-1). The formations present on Sand Mountain in the SWMU 23 area dip to the southeast on the eastern slope of the mountain and are overturned on the crest (Figure 2-6). Measured dips range from 32° (southeast) to 80° (overturned) moving up Sand Mountain to the west. The large variations in dip of the rocks on Sand Mountain and overturned beds are the result of complex folding and faulting along the Opossum Valley fault.

The Opossum Valley fault trace is inferred to be present at the contact between the Cambrian age Conasauga Formation and the Hartselle Formation located at the base of the mountain (Figures 2-6, 2-8, and 4-1). The fault slice trace, which is located approximately 500 ft west of SWMU 23, is interpreted to be present at the contact between the Fort Payne Chert and the Pottsville Formation. The fault slice is interpreted to be an anticlinal structure, plunging to the northeast, which was torn from the Birmingham Anticlinorium and faulted stratgraphically downward. The axis of the anticlinal structure of the fault slice trends northeast and is located in the Red Mountain Formation in the vicinity of SWMU 23 (Figure 2-6).

Monitor wells MW-21, MW-25S, and MW-25D were screened in fractured, micritic limestone, interpreted to be within water-bearing portions of the Conasauga Formation, just east of the Opossum Valley Fault. Monitor wells MW-23 and MW-24 were screened in sandstone and shale, interpreted to be within the mapped fault slice in water-bearing portions of the Pennsylvanian Parkwood Formation. Monitor well MW-22 was screened in slightly fractured limestone interpreted to be within the mapped fault slice in water-bearing portions of the Tuscumbia Limestone.

The soil overburden consists primarily of clay (CH to CL) with areas of cherty clay. Thickness of the soil overburden ranges from 0 to 38 feet. The soil overburden is thickest near monitor well MW-23 and thinnest at MW-22. The increased soil thickness in the vicinity of MW-23 is a result of weathering of the relatively less competent chert of the Fort Payne Chert formation. Significant non-native material, related to plant activities, was present overlying soils at monitor wells MW-25S and MW-25D.

4.1.2 Site Specific Hydrogeology

Lithologic samples, geophysical analysis, water-level measurements, and the results of the in-situ permeability testing were used to develop an understanding of the hydrogeology at SWMU 23.

4.1.2.1 Geophysical Evaluation

The geophysical evaluation included the FWI seismic survey conducted in 1995 and the conductivity survey conducted in July 1997. The FWI seismic survey report is presented in Appendix E of the RFI Facility-Wide Report and the Geophysical Investigation Report which presents the results of the conductivity survey is presented in Appendix B of this report.

4.1.2.1.1 Facility-Wide Seismic Investigation

Perimeter seismic data collected during the FWI detected three velocity zones at the site indicating differences in rock materials underlying the Sloss Facility. The three velocities were interpreted to consist of the following: (1) residual soil, (2) the weathered upper bedrock surface, and (3) hard rock with little secondary porosity.

Areas on Sand Mountain (S40 and S41 located west of SWMU 23) are underlain by three layers. The residual soil has velocities of about 2,000 ft/sec (feet/second) (Figure 3-4). The intermediate layer or weathered bedrock, where it exists, has a velocity usually somewhat less than 6,000 ft/sec. The hard bedrock, which was interpreted to have little secondary porosity, has average velocities exceeding 15,000 ft/sec. The higher velocity layer on Sand Mountain shows more variation in bedrock velocity and often have velocities less than 8,000 ft/sec. The lower velocities present on Sand Mountain are within the observed range of shale (6,000 to 10,000 ft/sec).

On Sand Mountain, both deep and shallow depths are observed for the high velocity bedrock. Depths range from approximately 10 feet to over 40 feet. Depths to bedrock of over 40 feet are encountered on spread S40 and indicates undulating weathering of the bedrock surface on Sand Mountain has occurred and often several feet of relief is developed over tens of feet.

4.1.2.1.2 Conductivity Survey

EM-31 and EM-34 conductivity survey lines are shown on Figure 3-2 and the Geophysical Investigation report is included as Appendix B. EM-31 and EM-34 readings were taken every 5 and 25 feet, respectively, and penetrated 18 and 50 ft bls, respectively. A total of four anomalous areas of high conductivity, labeled A, B, C, and D on Figures 1 and 2 of Appendix B, were observed in the EM-31 and EM-34 data.

Anomaly A was observed in the EM-31 and EM-34 data. Anomalies C and D, which occur in the same general region, were observed in the EM-31 and EM-34 data, respectively. Maximum observed conductivities at anomalies A, C, and D were approximately 30 millimho/m, which is slightly higher than average observed shallow and deep conductivities (less than 20 and less than 15 millimho/m, respectively). Anomalies A, C, and D occur in an area where shale and iron-rich sandstone of the Red Mountain Formation has been observed to outcrop and are approximately coincident with observed bedding planes. Shales are often conductive due to their bedding structure and high porosity.

Anomaly B is a well-defined feature and was only observed in the shallow EM-31 data. The well-defined nature of Anomaly B indicates it may be a result of increased soil thickness or increased bedrock porosity due to fracturing in the vicinity of the anomaly.

Increased conductivities which result from the presence of conductive fluids (e.g. leachate) in the subsurface are generally more extensive features than observed at Anomaly B.

4.1.2.2 Hydrogeology

In the vicinity of SWMU 23, the observed groundwater elevations range from 535.24 (MW-22) to 603.90 (MW-23) ft amsl (Table 2-2 and Figure 2-9). The direction of groundwater flow is to the east toward the base of Sand Mountain.

Hydraulic conductivities calculated from slug tests conducted on monitor wells surrounding SWMU 23 range from 6×10^{-6} cm/sec (MW-25D) to 3×10^{-3} cm/sec (MW-22) (Table 4-2). Relatively high conductivities in the Tuscumbia Limestone at monitor well MW-22 may be responsible for decreased observed water table elevations. The average horizontal hydraulic gradient in the vicinity of SWMU 23 is 0.100 ft/ft. This average hydraulic gradient was used to calculate groundwater flow velocities, using an assumed porosity of 0.20 for formation materials. Calculated groundwater flow velocities at SWMU 23 range from 3 ft/year (MW-25D) to 1000 ft/year (MW-22).

4.1.3 Sludge Sampling

Five (5) sludge samples (including 1 duplicate sample) were collected from four locations at SWMU 23 and analyzed for VOCs, SVOCs, PP Metals, barium, cyanide, and TCLP constituents (Table 3-2 and Figure 3-2).

4.1.3.1 Sludge Description

Sludge samples collected from SWMU 23 were black to moderate brown in color and were composed of clay/silt sized material (Appendix A.2). All sludge samples from SWMU 23 were moist to saturated and had a septic odor.

4.1.3.2 Chemical Characteristics

4.1.3.2.1 Total Volatile Organic Compounds

Five VOCs including 2-butanone, acetone, ethylbenzene, toluene, and xylenes were detected in sludge samples collected at SWMU 23 (Table 4-3).

4.1.3.2.2 Total Semivolatile Organic Compounds

Fifteen PAHs and 4-methylphenol (p-cresol) were detected in sludge samples collected at SWMU 23 (Table 4-3). Total PAH concentrations ranged from 55,600 to 357,100 μg/kg.

4.1.3.2.3 Total Metals and Cyanide

Cyanide and ten of the thirteen PP metals were detected in sludge samples collected at SWMU 23 (Table 4-3).

4.1.3.2.4 TCLP Analyses

TCLP VOCs, SVOCs, organochlorine pesticides, and chlorinated herbicides were not detected in sludge samples collected at SWMU 23 (Table 4-4). Two TCLP metals, barium and chromium, were detected in the sludge samples (Table 4-4). Barium was detected in all of the sludge samples and concentrations ranged from 3.5 to 18 milligrams per liter (mg/L). These concentrations were well below the RCRA TC level of 100 mg/L. Chromium was detected in two of four sludge samples at concentrations of 0.12 and 0.18 mg/L which were below the RCRA TC level of 5 mg/L.

4.1.4 Subsurface Soil Sampling

Nine (9) subsurface soil samples (including one duplicate sample) were collected at the five (5) monitor well locations around the perimeter of SWMU 23 and analyzed for VOCs, SVOCs, PP metals, barium, and cyanide (Table 3-3 and Figure 3-2).

4.1.4.1 Soil Description

Soils from SWMU 23 were composed primarily of light brown, stiff to plastic clay (CL to CH) with minor amounts of chert and sandstone fragments (Appendix A.3). Saturated soil conditions were not encountered until directly above the bedrock surface. No odor was detected in the soil samples and OVM readings were below detection limits in all samples.

4.1.4.2 Chemical Characteristics

4.1.4.2.1 Total Volatile Organic Compounds

Acetone was detected in one soil sample, 970805-LD-23-SL0025 (19-21), collected from SWMU 23 (Table 4-5). The detected acetone concentration was well below the USEPA Residential RBC of 7,800,000 µg/kg.

4.1.4.2.2 Total Semivolatile Organic Compounds

SVOCs were not detected in subsurface soil samples collected at SWMU 23 (Table 4-5).

4.1.4.2.3 Total Metals and Cyanide

Cyanide and nine of the 13 PP metals were detected in soil samples collected from SWMU 23 (Table 4-5). Detected barium, beryllium, cadmium, chromium, copper, lead, nickel, zinc, and cyanide concentrations were below USEPA Residential RBC concentrations.

Arsenic was detected above the USEPA Residential RBC of 0.43 mg/kg in all soil samples collected at SWMU 23 at concentrations ranging from 2 to 30 mg/kg. However, the concentration of arsenic in only one soil sample, 970805-LD-23-SL0024 (14-16), was outside the arsenic range observed in background soil samples (1.9 to 21 mg/kg) collected as part of the FWI (Table 4-1). Although total arsenic was detected in the sludge samples, the TCLP results (arsenic was not detected) indicate that arsenic is not leaching from the sludge into the soil.

4.1.5 Groundwater Quality

At SWMU 23, seven (7) groundwater samples (including one duplicate sample) were collected at monitor wells MW-21, MW-22, MW-23, MW-24, MW-25S, and MW-25D, and analyzed for VOCs, SVOCs, PP metals, barium, and cyanide (Figure 3-2). Field analyses conducted during groundwater sampling are summarized on Table 3-4.

4.1.5.1 Volatile Organic Compounds

Acetone was detected in groundwater sample 970818-LD-23-GW0022 collected from monitor well MW-22 (110 micrograms per liter [μg/L]); however, acetone was not detected in the soil sample collected at MW-22 (Tables 4-5 and 4-6). The detected acetone concentration was well below the USEPA RBC for tap water of 610 μg/L.

4.1.5.2 Semivolatile Organic Compounds

SVOCs were not detected in groundwater samples collected at SWMU 23 (Table 4-6).

4.1.5.3 Metals and Cyanide

Cyanide and metals including barium, chromium, copper, nickel, and zinc were detected in groundwater samples collected from SWMU 23 (Table 4-6). Detected cyanide and metal concentrations were below USEPA MCLs.

4.1.6 Summary

SWMU 23 is located on Sand Mountain on the fault slice mapped during the FWI. The fault slice, which is interpreted to be an anticlinal structure, is located between the hanging wall and the footwall of the Opossum Valley Fault. The formations present on Sand Mountain range from Silurian to Pennsylvanian age and dip to the southeast on the eastern slope of the mountain and are overturned on the crest.

Perimeter seismic data collected during the FWI detected three velocity zones at the site indicating differences in rock materials underlying the Sloss Facility. The three velocities were interpreted to consist of the following: (1) residual soil, (2) the weathered upper bedrock surface, and (3) hard rock with little secondary porosity. Depths to bedrock of over 40 feet were encountered in the seismic survey and indicates undulating weathering of the bedrock surface on Sand Mountain has occurred and often several feet of relief is developed over tens of feet.

A total of four anomalous areas of high conductivity, A, B, C, and D, were observed in the EM-31 and EM-34 data. Anomalies A, C, and D occur in an area where shale and iron-rich sandstone of the Red Mountain Formation has been observed to outcrop and are approximately coincident with observed bedding planes. Shales are often conductive due to their bedding structure and high porosity. The well-defined nature of Anomaly B indicates it may be a result of increased soil thickness or increased bedrock porosity due to fracturing in the vicinity of the anomaly. Increased conductivities which result from the presence of conductive fluids (e.g. leachate) in the subsurface are generally more extensive features than observed at Anomaly B.

In the vicinity of SWMU 23, the observed groundwater elevations range from 535.24 to 603.90 ft amsl. The direction of groundwater flow is to the east toward the base of Sand Mountain. Hydraulic conductivities calculated from slug tests conducted on monitor wells surrounding SWMU 23 range from 6 x 10^{-6} to 3 x 10^{-3} cm/sec and calculated groundwater flow velocities range from 3 to 1000 ft/year.

Five VOCs, 16 SVOCs including 15 PAHs and 4-methylphenol (p-cresol), 10 PP metals, and cyanide were detected in sludge samples collected from SWMU 23. TCLP metals barium and chromium were detected in the sludge samples collected from SWMU 23, but concentrations were well below RCRA TC levels.

Acetone, nine PP metals, and cyanide were detected in subsurface soil samples collected at SWMU 23. All detected parameters, except for arsenic, were below USEPA Residential RBCs for soil ingestion. Arsenic exceeded the USEPA Residential RBC in all subsurface soil samples; however, only one soil sample was outside the range for arsenic observed in background soil samples.

Acetone, barium, chromium, copper, nickel, zinc, and cyanide were detected in groundwater samples from SWMU 23. The USEPA RBC for tap water was not exceeded for acetone and USEPA MCLs were not exceeded for the other constituents.

4.1.7 Conclusions

Only one arsenic concentration (30 mg/kg) was outside the observed arsenic range (1.9 to 21 mg/kg) in background samples. Since all arsenic arsenic concentrations (2 to 30 mg/kg) exceeded the USEPA Residential RBC for soil ingestion (0.43 mg/kg), a risk evaluation will be prepared for this SWMU as proposed in the RFI Work Plan.

4.2 BLAST FURNACE EMMISIONS CONTROL WASTE PILE (SWMU 24)

4.2.1 Site Specific Geology

SWMU 24 is located east of the Opossum Valley Fault mapped during the FWI and is underlain by the Conasauga Formation (Figures 2-6 and 2-8). Measured dips of the Conasauga Formation range from 26° to 32° to the southeast.

Although monitor wells and piezometers have not been installed at SWMU 24, several monitor wells and FWI perimeter piezometers (P-2, P-3, P-4, MW-5, and MW-36) have been installed around the perimeter of the Sloss Facility or in adjacent SWMUs (Figure 2-2). These monitor wells and piezometers are screened in micritic limestone, interpreted to be within water-bearing portions of the Conasauga Formation. Typically, according to lithologic data, portions of the Conasauga Formation are more permeable near the weathered bedrock surface. Seismic data collected during the FWI indicated the upper Conasauga Formation has lower velocities and is more permeable than lower portions throughout the Sloss Facility.

The inferred bedrock topography of the SWMU 24 area is presented on Figure 2-8. The soil overburden at nearby piezometers and monitor wells consist primarily of clay (CH to CL) and the soil thickness ranges from 6 to 22 feet. The soil overburden is thickest at piezometer P-2 and thinnest at monitor well MW-5.

4.2.2 Site Specific Hydrogeology

Lithologic samples, geophysical analysis, water-level measurements, and the results of the in-situ permeability testing in SWMUs adjacent to SWMU 24 were used to infer the hydrogeology at SWMU 24.

In the vicinity of SWMU 24, the observed groundwater elevations range from 517.61 (P-2) to 535.14 (MW-36) ft amsl. The shallow groundwater flow direction is to the northeast toward Five Mile Creek (Table 2-2 and Figure 2-9).

A downward hydraulic gradient of 0.12 ft/ft was present at monitor well MW-5 and piezometer P-4, screened in the upper Conasauga Formation, on May 17, 1997.

Hydraulic conductivities calculated from slug tests conducted on piezometers and monitor wells surrounding SWMU 24 range from 4 x 10^{-8} cm/sec (P-4) to 9 x 10^{-3} cm/sec (MW-5) (Table 4-2). Piezometers P-4 and MW-5 are a piezometer couplet and P-4 is screened approximately 20 feet deeper than monitor well MW-5. The difference in conductivities between P-4 and MW-5 is probably a result of the former being screened within less permeable portions of the Conasauga Formation. The average horizontal hydraulic gradient in the vicinity of SWMU 24 is 0.025 ft/ft. This hydraulic gradient was used to calculate groundwater flow velocities using an assumed porosity of 0.01 for P-4 and 0.20 for the remaining piezometers and monitor wells. Calculated groundwater flow velocities surrounding SWMU 24 range from 0.1 ft/year (P-4) to 1000 ft/year (MW-5).

4.2.3 Sludge Sampling

Five (5) sludge samples (including 1 duplicate sample) were collected from four locations at SWMU 24 and analyzed for VOCs, SVOCs, PP metals, barium, cyanide, and TCLP constituents (Table 3-2 and Figure 3-1).

4.2.3.1 Sludge Description

Sludge samples collected from SWMU 24 were dusky brown in color and were composed of silt to fine grained sand sized material (Appendix A.2). All sludge samples from SWMU 24 were dry and had no odor.

4.2.3.2 Chemical Characteristics

4.2.3.2.1 Total Volatile Organic Compounds

VOCs were not detected in sludge samples collected from SWMU 24 (Table 4-7).

4.2.3.2.2 Total Semivolatile Organic Compounds

SVOCs were not detected in sludge samples collected from SWMU 24 (Table 4-7).

4.2.3.2.3 Total Metals and Cyanide

Cyanide and 11 of the 13 PP metals were detected in the SWMU 24 sludge samples (Table 4-7).

4.2.3.2.4 TCLP Analyses

TCLP VOCs, SVOCs, organochlorine pesticides, and chlorinated herbicides were not detected in the sludge samples (Table 4-8). Two TCLP metals, barium and cadmium, were detected in the sludge samples (Table 4-8). Barium was detected in all of the sludge samples and concentrations ranged from 0.6 to 1.2 mg/L. These concentrations were well below the RCRA TC level of 100 mg/L for barium. Cadmium was detected in four of the five sludge samples at concentrations ranging from 0.01 to 0.06 mg/L, which were below the RCRA TC level of 1 mg/L.

4.2.4 Surficial Soil Sampling

Sixteen (16) subsurface soil samples (including one duplicate sample) were collected at fifteen (15) locations around the perimeter of SWMU 24 and analyzed for VOCs, SVOCs, PP metals, barium, and cyanide (Table 3-1 and Figure 3-1).

4.2.4.1 Soil Description

Soils from SWMU 24 were composed primarily of moderate brown, stiff to plastic clay (CL to CH) with some light brown to grayish orange mottling, root material, and minor amounts of rock fragments (Appendix A.1). Saturated soil conditions were not encountered in soil samples from locations 24-SL0005 and 24-SL0007; soil samples from the remaining locations were dry to moist. No odors were detected in soil samples except for the sample from location 24-SL0007. Soil collected from sample location 24-SL0007 had a chemical odor and minor amounts of a black "tar-like" substance was observed in the sample.

4.2.4.2 Chemical Characteristics

4.2.4.2.1 Total Volatile Organic Compounds

Acetone was detected at 150 μg/kg in one soil sample, 970618-LD-24-SL0012, collected from SWMU 24 (Table 4-9). The detected concentration was well below the USEPA Residential RBC of 7,800,000 μg/kg. No other VOCs were detected in surficial soil samples collected at SWMU 24.

4.2.4.2.2 Total Semivolatile Organic Compounds

Sixteen PAHs were detected in surficial soil samples collected at SWMU 24 (Table 4-9). Concentrations of acenaphthene, anthracene, chrysene, fluoranthene, fluorene, naphthalene, and pyrene detected were below USEPA Residential RBCs for soil ingestion in all samples. There are no USEPA Residential RBCs calculated for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected above their USEPA Residential RBCs (Table 4-9).

PAHs were not detected in sludge samples collected at SWMU 24. The absence of PAHs in the sludge samples suggests that PAHs detected in surficial soil samples are not derived from the sludge material.

Soil samples that contain concentrations of PAHs exceeding USEPA Residential RBCs are located in areas where runoff collects or drainage from areas upgradient of SWMU 24 occurs. Soil location 24-SL0003 and 24-SL0005 are adjacent to a drainage ditch located along the north side of Summit Street and location 24-SL0007 is adjacent to a drainage ditch located between SWMU 24 and the BTF (Figure 3-1). Soil location 24-SL0014 is located near a low area where standing water was observed during sampling. Soil location 24-SL0011 and 24-SL0012 are located east of the storm water runoff sewer (SWMU 23). Soil locations 24-SL0015 and 24-SL0016 are located adjacent to the road that was used to transport sludge to SWMU 23.

The distribution of PAHs that exceed USEPA Residential RBCs, except for 24-SL0011 and 24-SL0012, suggests the presence of the PAHs may be related to transport from sources upgradient of SWMU 24 and possibly offsite sources. Elevated PAH concentrations at soil sampling locations 24-SL0011 and 24-SL0012 may be related to past waste management practices when plant wastes were discharged directly to the polishing pond area prior to construction of the BTF in 1976.

4.2.4.2.3 Total Metals and Cyanide

Cyanide and 12 of the 13 PP metals were detected in surficial soil samples collected from SWMU 24. Cyanide and all other detected metals except for arsenic were below USEPA Residential RBCs for soil ingestion.

Arsenic concentrations ranged from 5.5 to 21 mg/kg and exceeded the USEPA Residential RBC of 0.43 mg/kg in all soil samples; however, detected arsenic concentration were within the range of arsenic detected in background soil samples (1.9 to 21 mg/kg) (Tables 4-1 and 4-9). Although total arsenic was detected in the sludge samples, TCLP results (arsenic was not detected) indicate that arsenic is not leaching from the sludge into the soil.

4.2.5 <u>Summary</u>

SWMU 24 is located east of the Opossum Valley and is underlain by the Conasauga Formation. Measured dips of the Conasauga Formation range from 26° to 32° to the southeast. The soil overburden at nearby piezometers and monitor wells consist primarily of clay (CH to CL) and the soil thickness ranges from 6 to 22 feet.

In the vicinity of SWMU 24, the observed water table elevations range from 517.61 to 535.14 ft amsl and the shallow groundwater flow direction is to the northeast toward Five Mile Creek. Hydraulic conductivities calculated from slug tests conducted on piezometers and monitor wells surrounding SWMU 24 range from 4×10^{-8} to 9×10^{-3} cm/sec and calculated groundwater flow velocities range from 0.1 to 1000 ft/year.

Cyanide and 11 of the 13 PP metals were detected in sludge samples from SWMU 24. TCLP metals, barium, and cadmium, were detected in the sludge samples but were below RCRA TC levels.

Acetone, sixteen PAHs, 12 of the 13 PP metals, and cyanide were detected in surficial soil samples from SWMU 24. Benzo(a)anthracene, benzo(a)pyrene benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected above USEPA Residential RBCs in several soil samples. PAHs were not detected in sludge samples collected at SWMU 24. The absence of PAHs in the sludge samples suggests that the PAHs detected in surficial soil samples are not derived from the sludge material. The presence of PAHs in the soil may be a result of transport from upgradient and possibly offsite sources or past waste management practices. Arsenic exceeded the Residential RBC; however, the arsenic concentrations were within observed concentration ranges in background soil samples.

4.2.6 <u>Conclusions</u>

Since concentrations of benzo(a)pyrene (430 to 36,000 μg/kg), benzo(a)anthracene (2,050 to 63,000 μg/kg), benzo(b)fluoranthene (980 to 33,000 μg/kg), benzo(k)fluoranthene (16,000 μg/kg), dibenzo(a,h)anthracene (570 μg/kg), indeno(1,2,3-cd)pyrene (1,300 to 22,000 μg/kg), and arsenic (5.5 to 21 mg/kg) detected at SWMU 24 exceeded USEPA Residential RBCs for soil ingestion, a risk evaluation is appropriate for this SWMU.

4.3 LANDFILL AND BLAST FURNACE EMISSION CONTROL SLUDGE WASTE PILE NEAR LANDFILL (SWMUS 38 AND 39)

4.3.1 <u>Site Specific Geology</u>

SWMUs 38 and 39 are located east of the Opossum Valley Fault mapped during the FWI and are underlain by the Conasauga Formation. Measured dips range from 26°

to 32° to the southeast. The geology and structural features discussed below are depicted on Figures 2-6, 2-7, and 4-2. The cross section locations are presented on Figure 2-2.

Monitor wells MW-26 through MW-36 were screened in a micritic limestone interpreted to be within water-bearing portions of the Conasauga Formation, just east of the Opossum Valley fault. At SWMUs 38 and 39, a high degree of fracturing was observed in the vicinity of monitor wells MW-27, MW-29, MW-30S, MW-30D, MW-33 and MW-37. MW-35 appears to be screened within a relatively less permeable portion of the upper Conasauga Formation and may indicate that little weathering and or fracturing of the bedrock is present. Monitor well MW-26 and MW-34D are screened within less permeable portions of the deep Conasauga Formation (> 140 ft bls). Monitor wells MW-26, MW-34D, and MW-35 pumped dry during development and groundwater sampling. After 24 hours, water levels in these wells did not recover and were significantly less than the initial water levels measured in the wells prior to pumping.

The soil overburden consists primarily of clay (CH to CL) with areas of sandy and gravely clay. Thickness of the soil overburden ranges from 0 to 38 feet. The soil overburden is thickest in the near monitor well MW-27 and thinnest at MW-37. Significant non-native material related to plant activities was present overlying soils or almost directly on top of the bedrock surface at monitor wells MW-31, MW-32, MW-33, MW-34S, MW-34D, and MW-35 (Figure 4-2). Bedrock topography for the SWMU 38 and 39 area is presented in Figure 2-8.

4.3.2 Site Specific Hydrogeology

Lithologic samples, geophysical surveys, water-level measurements, and the results of the in-situ permeability testing were used to develop an understanding of the hydrogeology at SWMUs 38 and 39.

4.3.2.1 Geophysics Evaluation

The FWI seismic survey report is presented in Appendix E of the RFI Facility-Wide Report and the Geophysical Investigation Report which presents the results of the conductivity and/or resistivity survey are presented in Appendix B of this report.

4.3.2.1.1 Facility-Wide Seismic Investigation

Perimeter seismic data collected during the FWI detected three velocity zones at the site indicating differences in rock materials underlying the Sloss Facility. The three velocities were interpreted to consist of the following: (1) residual soil, (2) the weathered upper bedrock surface of the Conasauga Limestone, and (3) hard rock with little secondary porosity.

Seismic spreads indicated that residual soil rests on an intermediate layer of fractured and weathered bedrock which in turn rests on a high velocity bedrock west of the LaFarge Quarry (S5, S6, S29, S35) (Figure 3-4). Residual soils at the northern end of the main plant area, where SWMUs 38 and 39 are located, have more variable velocities, generally ranging from 2000 ft/sec to over 4,000 ft/sec.

The intermediate layer or weathered limestone, where it exists, has a velocity usually somewhat less than 6,000 ft/sec. The velocity of the intermediate layer is at the lower end of the range of velocity observed in weathered limestone.

The higher velocity layer (hard bedrock with little secondary porosity) in the northern end of the main plant, where SWMUs 38 and 39 are located, show some variation in bedrock velocity and often have velocities less than 8,000 ft/sec. Two spreads in the north end of the main plant area, centered about spreads S6 and S29 (near monitor wells MW-34S, MW-34D, MW-35, MW-37 and MW-27), have higher velocities exceeding 20,000 ft/sec and reflect the presence of unweathered and unfractured blocks of bedrock.

The northern part of the main plant area, which includes SWMUs 38 and 39, has variable high velocity bedrock depths generally over 20 feet. Bedrock in the north end of the main plant area is generally deeper than in the rest of the site. The deeper areas are seen on spreads S6, S34, and S35. Seismic data indicates variable weathering of the top of the Conasauga Formation has occurred and often several feet of relief is developed over tens of feet.

4.3.2.1.2 Conductivity/Resistivity Survey

EM-31 conductivity and resistivity survey lines are shown on Figure 3-3 and the Geophysical Investigation report is included as Appendix B. EM-31 readings were taken every 5 feet around the northern, eastern, and southern perimeter of SWMUs 38 and 39 and penetrated approximately 20 ft bls. Shallow resistivity readings were collected along the western perimeter of SWMU 38 with a 20-foot array length. Deep resistivity readings were collected around the perimeter of SWMUs 38 and 39 with a 100-foot array length.

Before any resistivity data was recorded two Schlumberg soundings (S1 and S2) were conducted on the western and eastern side of SWMUs 38 and 39, respectively. Results of the two soundings indicates bedrock is at 9.5 and 21 ft bls at S1 and S2, respectively, and the overburden is more conductive than the limestone bedrock. Furthermore, Schlumberg soundings confirm the general rock resistivity assumptions used for evaluating the resistivity data.

A total of four anomalous areas of high conductivity, labeled E, F, G, and H on Figures 1 and 2 of Appendix B, were observed in the EM-31 and resistivity data. Anomaly E, F, and H were observed in the EM-31 and resistivity data. Anomaly G was only observed in the EM-31 data.

Anomalies E and F are broad features in the shallow and deep data. An underground pipe connecting the storm water runoff sewer (SWMU 25) to the polishing pond at the BTF is present in the vicinity of Anomaly E and may be the cause of higher conductivities in this region. Higher conductivities at Anomaly E may also be the result of increased overburden thickness in this area although drilling logs and seismic data indicate the soil thickness is approximately constant or thinner in this area.

Review of historic aerial photos indicates Summit Road was realigned in the late 1970's over portions of SWMU 24 which is composed of sludge (flue dust) generated in the former blast furnace. Anomalies E and F are in the area formerly occupied by SWMU 24 and higher conductivities in this area may be a result of the presence of minor amounts of flue dust material beneath the road not removed during realignment of Summit Road. Anomalies E and F are similar to Anomaly H which is believed to be due to the presence of flue dust in this area.

Anomaly G is only present in the shallow data and coincides with the overhead contact cooling water pipeline. Anomaly G is not considered to be an indicator of a bedrock anomaly in this area.

Anomaly H is present in both the shallow and deep data and is thought to be due to the presence of conductive sludge (flue dust) material in the subsurface at this location. Flue dust was observed at the surface in the vicinity of Anomaly H during the geophysical field program. The geophysics survey line was located close to the waste pile at the southern end of SWMU 39 in order to minimize the effect of overhead power lines present at this location and due to the presence of slag piles related to activities conducted by Vulcan Materials. Vulcan Materials leases the property south of SWMU 39 from Sloss Industries.

4.3.2.2 Hydrogeology

In the vicinity of SWMUs 38 and 39, the observed groundwater elevations in the upper Conasauga Formation range from 516.13 (MW-35) to 552.59 (MW-32) ft amsl (Table 2-2 and Figure 2-9). The observed potentiometric surface elevations in the lower Conasauga Formation range from 464.10 (MW-26) to 540.41 (MW-34D) ft amsl (Table 2-2 and Figure 2-10). The potentiometric surface elevations in the upper and lower Conasauga Formation at monitor well couplet MW-34S and MW-34D are approximately equivalent. However, the potentiometric surface elevation at monitor well MW-26 is significantly less than the potentiometric surface elevation at nearby monitor well MW-27 and indicates the upper and lower units are not hydraulically connected at all locations throughout the site.

An upward vertical hydraulic gradient of 0.0010 ft/ft was present at monitor wells MW-30S and MW-30D, screened in the upper Conasauga Formation, on August 17, 1997. An upward and downward hydraulic gradient of 0.0057 and 0.69 ft/ft was present between the upper and lower Conasauga Formation at monitor wells pairs MW-34S/MW-34D and MW-26/MW-27, on August 17, 1997, respectively. The change in hydraulic gradients at monitor well pairs MW-34S/MW-34D and MW-26/MW-27 may be a result of complex recharge/discharge relationships caused by ongoing mining activities at the Southern Ready Mix Quarry located approximately ¼ mile northeast of Sloss Industries.

The groundwater flow direction in the upper Conasauga Formation is to the northeast toward Five Mile Creek (Figure 2-9). In the SWMU 38 and 39 area, the groundwater flow direction in the lower Conasauga Formation appears to be to the south (Figure 2-10).

Hydraulic conductivities calculated from slug tests performed in the upper portion of the Conasauga Formation surrounding SWMUs 38 and 39 range from 4 x 10^{-8} cm/sec (MW-35) to 7 x 10^{-2} cm/sec (MW-29). Hydraulic conductivities at SWMUs 38 and 39 in the lower, less permeable portions of the Conasauga Formation range from 1 x 10^{-7} to 2 x 10^{-7} cm/sec at MW-34D. The average hydraulic gradient in the vicinity of SWMUs 38 and 39 is 0.025 ft/ft. This average hydraulic gradient was used to calculate groundwater flow velocities using an assumed porosity of 0.20 for upper Conasauga Formation materials. For monitor well MW-35, screened within the upper Conasauga Formation, a porosity of 0.01 was used since well recovery was similar to wells screened within the lower Conasauga Formation. Calculated groundwater flow velocities in the upper Conasauga Formation range at SWMUs 38 and 39 from 0.3 ft/year (MW-35) to 9000 ft/year (MW-29). Calculated groundwater flow velocities in the lower Conasauga Formation, which were calculated using the same gradient as in the upper Conasauga Formation and a porosity of 0.01, range from 0.3 to 0.6 ft/year at MW-34D.

4.3.3 SWMU 39 Sludge Sampling

Seven (7) sludge samples (including 1 duplicate sample) were collected from six locations at SWMU 39. Four of the six samples were analyzed for VOCs, SVOCs, PP metals, barium, cyanide, and TCLP constituents (Table 3-2 and Figure 3-3).

4.3.3.1 Sludge Description

Sludge samples collected from SWMU 39 were dusky brown in color and were composed of silt to fine grained sand sized material (Appendix A.2). All sludge samples from SWMU 39 were dry and had no odor.

4.3.3.2 Chemical Characteristics

4.3.3.2.1 Total Volatile Organic Compounds

VOCs were not detected in sludge samples collected from SWMU 24 (Table 4-10).

4.3.3.2.2 Total Semivolatile Organic Compounds

One SVOC, benzo(k)fluoranthene, was detected in sludge sample 970619-LD-39-SM0006 at a concentration of 30 μg/kg (Table 4-10).

4.3.3.2.3 Total Metals and Cyanide

Cyanide and 10 of the 13 PP metals were detected in sludge samples collected from SWMU 39 (Table 4-10).

4.3.3.2.4 TCLP Analyses

TCLP VOCs, SVOCs, organochlorine pesticides, and chlorinated herbicides were not detected in sludge samples (Table 4-11). TCLP metals, barium, and cadmium, were detected in the sludge samples collected at SWMU 39 (Table 4-11). Barium was detected in three of the four samples and concentrations ranged from 0.91 to 2.8 mg/L. These concentrations were well below the RCRA TC level of 100 mg/L. Cadmium was detected in sludge sample 970616-LD-39-SM0002 at a concentration of 0.036 mg/L which was below the RCRA TC level of 1 mg/L.

4.3.4 Subsurface Soil Sampling

Nineteen (19) subsurface soil samples (including two duplicate samples) were collected at ten (10) locations monitor well locations around the perimeter of SWMUs 38 and 39 and analyzed for VOCs, SVOCs, PP metals, barium, and cyanide (Table 3-3 and Figure 3-3).

4.3.4.1 Soil Description

Soils from SWMU 38 were composed primarily of pale yellowish brown to moderate reddish brown, stiff to plastic clay (CL to CH) with some dusky red mottling, iron concretions, and minor amounts of micritic limestone fragments (Appendix A.3). Soils from SWMU 39 were composed primarily of light brown to pale olive, stiff to plastic clay (CL to CH) with minor amounts of rounded pebbles and micritic limestone fragments. Saturated soil conditions were not encountered until directly above the bedrock surface. No odor was detected in soil samples and OVM readings were below detection limits in all samples.

4.3.4.2 Chemical Characteristics

4.3.4.2.1 Total Volatile Organic Compounds

Toluene was detected in soil sample 970804-LD-38-SL9026 (duplicate of 970804-LD-38-SL0026 (10-12) at 8 μg/kg (Table 4-12). The concentration of toluene detected was below the USEPA Residential RBC of 16,000,000 μg/kg. In the remaining samples collected from SWMUs 38 and 39, VOCs were not detected (Table 4-12).

4.3.4.2.2 Total Semivolatile Organic Compounds

SVOCs were not detected in subsurface soil samples collected from SWMUs 38 and 39 (Table 4-12).

4.3.4.2.3 Total Metals and Cyanide

Cyanide and 10 of the 13 PP metals were detected in soil samples collected from SWMUs 38 and 39 (Table 4-12). Detected antimony, barium, beryllium, chromium, copper, lead, nickel, silver, zinc, and cyanide concentrations were below USEPA Residential RBCs.

Arsenic was detected above the USEPA Residential RBC of 0.43 mg/kg in 17 of the 19 soil samples (including the two duplicates) at concentrations ranging from 1.8 to 5.1 mg/kg. All concentrations of arsenic that exceeded the USEPA Residential RBC were within the range observed in background soil samples (1.9 to 21 mg/kg) collected as part of the FWI (Table 4-1). Although total arsenic was detected in the sludge samples from SWMU 39, the TCLP results (arsenic was not detected) indicate that arsenic is not leaching from the sludge into the soil.

4.3.5 <u>Groundwater Quality</u>

Fifteen (15) groundwater samples (including one duplicate sample) were collected at SWMUs 38 and 39 from monitor wells MW-26, MW-27, MW-28, MW-29, MW-30S, MW-30D, MW-31, MW-32, MW-33, MW-34S, MW-34D, MW-35, MW-36, and MW-37. The groundwater samples were analyzed for VOCs, SVOCs, PP metals, barium, and cyanide (Figure 3-3). Field analyses conducted during groundwater sampling are summarized on Table 3-4.

4.3.5.1 Volatile Organic Compounds

VOCs including acetone, benzene, toluene, trichloroethene, and xylenes were detected in groundwater samples collected from SWMUs 38 and 39 (Table 4-13). Detected toluene, trichloroethene, and xylene concentrations were below USEPA MCLs and acetone was below the USEPA RBC for tap water.

Benzene was detected above the USEPA MCL of 5 μg/L in groundwater samples 970821-LD-38-GW0026 (13 μg/L) and 970831-LD-39-GW0034D (6 μg/L) collected from the deep Conasauga Formation (Table 4-13). Benzene was not detected in sludge or soil samples collected at SWMUs 38 and 39.

4.3.5.2 Semivolatile Organic Compounds

SVOCs were not detected in groundwater samples collected from SWMUs 38 and 39 (Table 4-13).

4.3.5.3 Metals and Cyanide

Cyanide and PP metals including barium, chromium, copper, zinc, lead, and silver were detected in groundwater samples collected from SWMUs 38 and 39 (Table 4-13). Detected barium, chromium, copper, and zinc concentrations were below USEPA MCLs.

Lead was detected above the USEPA MCL of 0.015 mg/L in groundwater sample 970821-LD-39-GW0034D (0.04 mg/L) (Table 4-13). This elevated concentration of lead may be attributed to suspended sediment in the well since the water was slightly turbid. Silver was detected above the USEPA MCL of 0.1 mg/L in groundwater sample 970821-LD-39-GW0036 (0.24 mg/L) (Table 4-12).

Cyanide was detected in six of the eight groundwater samples collected at SWMU 39 but concentrations only exceeded the USEPA MCL of 0.2 mg/L in two of the six groundwater sampling locations. The USEPA MCL for cyanide was exceeded in groundwater samples 970821-LD-39-GW0032 (0.38 mg/L), 970820-LD-39-0034S (0.21 mg/L), and 970820-LD-39-9034S (duplicate of 970820-LD-39-0034S) (0.22 mg/L) which are located in the vicinity of the southern portion of SWMU 39. Cyanide was not detected in monitor wells installed around the perimeter of SWMU 38.

4.3.6 Summary

SWMUs 38 and 39 are located east of the Opossum Valley Fault mapped during the FWI and are underlain by the Conasauga Formation. Measured dips range from 26° to 32° to the southeast. The soil overburden ranges from 0 to 38 ft thick and consists primarily of clay (CH to CL) with areas of sandy and gravely clay; however, significant non-native material related to plant activities was present overlying soils or almost directly on top of the bedrock surface at monitor wells in the area of SWMU 39.

Perimeter seismic data collected during the FWI detected three velocity zones at the site indicating differences in rock materials underlying the Sloss Facility and in the SWMU 38 and 39 areas. The three velocities were interpreted to consist of the following: (1) residual soil, (2) the weathered upper bedrock surface of the Conasauga Limestone, and (3) hard rock with little secondary porosity. Bedrock in the north end of the main plant area in the SWMU 38 and 39 area is generally deeper than in the rest of the site. Seismic data indicates variable weathering of the top of the Conasauga Formation has occurred and often several feet of relief is developed over tens of feet.

A total of four anomalous areas of high conductivity, labeled E, F, G, and H were observed in the EM-31 and resistivity data. Anomalies E and F are in the area formerly occupied by SWMU 24 and higher conductivities in this area may be a result of the presence of minor amounts of flue dust material beneath the road not removed during realignment of Summit Road. Anomaly G is only present in the shallow data and coincides with the overhead contact cooling water pipeline. Anomaly H is present in both the shallow and deep data and is thought to be due to the presence of conductive sludge (flue dust) material in the subsurface at this location.

In the vicinity of SWMUs 38 and 39, the observed groundwater elevations in the upper Conasauga Formation range from 516.13 to 552.59 ft amsl and the groundwater flow direction is to the northeast toward Five Mile Creek. Hydraulic conductivities calculated from slug tests performed in the upper portion of the Conasauga Formation range from 4×10^{-8} to 7×10^{-2} cm/sec and calculated groundwater flow velocities range from 0.1 to 9000 ft/year.

The observed potentiometric surface elevations in the lower Conasauga Formation range from 516.13 to 552.59 ft amsl and the groundwater flow direction appears to be to the south. Hydraulic conductivities at SWMUs 38 and 39 in the lower, less permeable portions of the Conasauga Formation range from 1×10^{-7} to 2×10^{-7} cm/sec at MW-34D and calculated groundwater flow range from 0.3 to 0.6 ft/year at MW-34D.

One SVOC, benzo(k)fluoranthene, 10 of the 13 PP metals, and cyanide were detected in sludge samples collected from SWMU 39. Barium and cadmium were detected in TCLP sludge samples but concentrations were below RCRA TC levels.

One VOC, toluene, 10 of the 13 PP metals, and cyanide were detected in subsurface soil samples collected from SWMUs 38 and 39. Detected toluene and PP metals, except arsenic, and cyanide concentrations were below USEPA Residential RBCs in all samples. Arsenic was detected above the USEPA Residential RBC; however, concentrations were within the range observed in background soil samples. Although total arsenic was detected in the sludge samples from SWMU 39, the TCLP results indicate that arsenic is not leaching from the sludge into the soil.

Five VOCs, six PP metals, and cyanide were detected in groundwater samples collected at SWMUs 38 and 39. Benzene and lead were above USEPA MCLs in groundwater samples collected in the deep water-bearing zone of the Conasauga Formation. Silver exceeded the USEPA MCL in one monitor well in the upper Conasauga. Cyanide was detected in six of the eight groundwater samples collected at SWMU 39; however, cyanide was not detected in groundwater samples collected from SWMU 38.

4.3.7 Conclusions

Since detected concentrations of arsenic (1.8 to 5.1 mg/kg) in subsurface soils and benzene (6 to 13 μg/L), lead (0.04 mg/L), silver (0.24 mg/L), cyanide (0.21 to 0.38 mg/L) in groundwater at SWMUs 38 and 39 exceeded Residential RBCs for surficial soil and USEPA MCLs, a risk evaluation is appropriate for this SWMU.

5.0 BASELINE RISK ASSESSMENT

A baseline risk assessment was conducted for the Land Disposal Areas following USEPA Region 4 Guidance (USEPA, 1996a). Four SWMUs (SMWU 23, 24, 38, and 39) were included in the evaluation of the Land Disposal Areas. The purpose of a baseline risk assessment is to determine the potential risk to human health and the environment posed by chemical constituents detected at the site. The analytical data presented in Section 4 of this report were used to conduct the risk assessment.

5.1 DATA ANALYSIS

Constituents of potential concern (COCs) were selected according to USEPA (1996a) criteria by comparison of maximum concentrations to risk-based screening levels and to twice background concentrations. Background data for soil were presented in Table 2-1. The USEPA Region 3 RBCs (2000) used for screening were obtained directly from the table for carcinogens and were adjusted to a level equivalent to a hazard quotient (HQ) of 0.1 for non-carcinogens (USEPA, 1996a).

Soil, sludge, and groundwater samples were collected from the four SWMUs associated with the Land Disposal Areas. The analytical data were evaluated following the guidelines provided by the USEPA (1989b; 1996a) for use in the risk assessment as described below:

- All constituents never detected in the samples were eliminated from further analysis for that group.
- For non-detects, one-half the sample quantitation limit (SQL) was used as a surrogate concentration (rather than using zero or eliminating the data point).

The results of the statistical analyses are presented in the constituent occurrence tables for the four SWMUs. The data were divided based on geographical location as seen in Figure 1-2 with SWMUs 23 and 24 evaluated individually and SWMUs 38 and 39 evaluated together. The information in the constituent occurrence tables (Tables 5-1 through 5-8) includes, for each detected constituent, the frequency of detection (ratio of the number of detections to the total number of samples in that group), the range of SQLs used to calculate surrogate concentrations for non-detections in the statistical calculations, the range of detected values, the average detection, the arithmetic mean (using surrogate concentrations for non-detections) assuming a log-normal distribution, the 95 percent upper confidence level (UCL) on the mean, and the exposure point concentration (EPC). Tables 5-1, 5-2, and 5-3 summarize the data collected for subsurface soil, sludge, and groundwater at SWMU 23, respectively. At SWMU 24, surface soil and sludge data were collected and are summarized in Tables 5-4 and 5-5, respectively. Subsurface soil data for SWMUs 38 and 39 are summarized in Table 5-6, while sludge data are provided in Table 5-7. Groundwater data are summarized in Table 5-8 for SWMUs 38 and 39. Groundwater data were not available for SWMU 24.

5.1.1 COCs in Soil/Sludge

Constituents detected in soil and sludge were divided into chemical classes of PAHs, VOCs, SVOCs, and inorganics. The PAHs were divided further into carcinogenic and non-carcinogenic classes. To identify the COCs, the maximum detected concentration of each constituent in the surface soil and sludge samples was compared to residential screening values for soil ingestion determined at a cancer risk level of 10^{-6} or a HQ of 0.1 following USEPA (1996a) guidelines. Maximum concentrations in subsurface soil samples were compared to industrial screening values for soil ingestion at the same 10^{-6} and 0.1 risk levels. Those constituents that exceeded the screening values were identified as COCs. Additionally, for constituents detected in soil and sludge, if one compound in any chemical class (except for inorganics) exceeded the screening levels and was identified as a COC, all compounds in that chemical class were considered to be COCs. For example, if chrysene, a potentially carcinogenic PAH, were detected below its RBC, it would still be included as a COC if other potentially carcinogenic PAHs were detected above their RBCs. Table 5-9 presents the results of the selection of COCs for subsurface soils for SWMU 23, and arsenic was identified as the only COC. The COCs for sludge for SWMU 23 are presented in Table 5-10 and include carcinogenic PAHs and five inorganics (arsenic, chromium, mercury, nickel, and selenium).

The surface soil and sludge COCs for SWMU 24 are identified in Tables 5-11 and 5-12, respectively. The carcinogenic PAHs and three inorganics (antimony, cadmium, and chromium) were selected as COCs in the surface soils. The sludge COCs included the three surface soil inorganics as well as lead and zinc.

None of the constituents detected in the subsurface soil at SWMUs 38 and 39 were retained as COCs, as seen in Table 5-13. Table 5-14 summarizes the criteria for COC selection for the sludge for SWMUs 38 and 39. The COCs selected for sludge at SWMUs 38 and 39 are antimony, cadmium, and zinc.

5.1.2 COCs in Groundwater

To identify the COCs in groundwater at each SWMU, the maximum detected concentrations of each constituent were compared to the tap water screening values at a cancer risk level of 10^{-6} or a HQ of 0.1 following USEPA (1996a) guidelines. Those constituents that exceeded the screening values were identified as COCs. Three VOCs and five inorganics were selected as COCs in groundwater, as described below.

Table 5-15 presents the COCs for groundwater at SWMU 23. One VOC (acetone) and two metals (barium and chromium) were detected at concentrations greater than the tap water RBC and thus were identified as COCs. Groundwater samples were not collected from SWMU 24, and thus no COCs could be identified for that area. At SWMUs 38 and 39, three VOCs and five inorganics were identified as COCs in groundwater (Table 5-16). Acetone, benzene, and trichloroethene are the volatile COCs, while barium, chromium, cyanide, lead, and silver are the inorganic COCs.

A comprehensive list of COCs by SWMU for each medium is presented in Table 5-17.

5.2 TOXICITY ASSESSMENT

This section discusses the two general categories of toxicity values (non-carcinogenic and carcinogenic) used to evaluate risk. Toxicity values for non-carcinogenic and carcinogenic effects were obtained from the USEPA's Integrated Risk Information System (IRIS) (2000) and USEPA's Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997a).

5.2.1 Non-Carcinogens

The reference dose (RfD) is an estimate of a daily exposure level that is unlikely to cause non-carcinogenic health effects. Thus, exposure levels below the RfD are unlikely to produce toxic effects in even sensitive subpopulations. Chronic RfDs are used to assess long-term exposures ranging from 7 years to a lifetime; subchronic RfDs evaluate the potential of adverse health effects associated with exposure to chemicals during a period of 2 weeks to 7 years. RfDs are derived by the USEPA by dividing the no observed adverse effect levels (NOAELs) or lowest observed adverse effect levels (LOAELs) by uncertainty factors typically ranging from 10 to 10,000 depending on the suitability and quality of the available data.

RfDs that are approved by the USEPA are called verified reference doses for oral exposure (RfD_os) and reference concentrations (RfCs) for inhalation exposure. Table 5-18 presents the RfD_os and RfCs used in this risk assessment. Target sites affected by each constituent are shown in the table for both inhalation and oral exposures. The confidence level and uncertainty factors associated with the toxicity values also are listed. The uncertainty factor represents a specific area of uncertainty inherent in the extrapolation from the available data. The confidence levels (low, medium, and high) assess the degree of confidence the USEPA has in the database used to develop the toxicity value.

Toxicity values to evaluate non-carcinogenic effects are not available for all of the PAHs. As a result, pyrene was selected as a surrogate for those non-carcinogenic PAHs without toxicity values. Pyrene also was used as a surrogate to characterize non-carcinogenic effects of the carcinogenic PAHs.

Toxicity values for dermal exposure are not available (appropriate toxicity data are scarce); therefore, the oral RfDs are adjusted to an absorbed dose, using the constituent-specific oral absorption efficiency, as recommended by the USEPA (1989b). This correction is necessary due to the differences in absorption between the skin and the gastrointestinal (GI) tract. In calculating a dermal RfD from an oral RfD, the oral RfD is multiplied by the oral absorption efficiency. Oral absorption efficiencies for the COCs are provided in Table 5-19. The adjusted oral RfDs for the COCs are provided in Table 5-20.

5.2.2 Carcinogens

Constituents are classified as known, probable, or possible human carcinogens based on the USEPA weight-of-evidence scheme in which chemicals are systematically evaluated for their ability to cause cancer in humans or laboratory animals. The USEPA classification scheme (USEPA, 1989b) contains six classes (five if B1 and B2 are classified together under the heading of Class B), based on the weight of available evidence, as follows:

- A Known human carcinogen;
- B1 Probable human carcinogen -- limited evidence in humans;
- B2 Probable human carcinogen -- sufficient evidence in animals and inadequate data in humans;

C Possible human carcinogen -- limited evidence in animals;

D Inadequate evidence to classify; and

E Evidence of non-carcinogen city.

Constituents in Classes A, B1, B2, and C generally are included in risk assessments as potential human carcinogens; however, Class C carcinogens may be evaluated on a case-by-case basis (USEPA, 1989b). In this risk assessment, the only Class C carcinogen detected was naphthalene. Since there is no cancer slope factor (CSF) for naphthalene, it was not evaluated with the Class A and B carcinogens.

The USEPA currently uses the linearized multistage model for extrapolating cancer risk from high doses associated with occupational exposure or laboratory animal studies to low doses typically associated with environmental exposures. The model provides a 95 percent upperbound estimate of cancer incidence at a given dose. The slope of the extrapolated curve, called the CSF, is used to calculate the probability of cancer associated with the exposure dose. Inhalation exposures are evaluated using the unit risk factor (UR_i).

CSFs are derived from the assumption that any dose level has a probability of causing cancer. The cumulative dose, regardless of the exposure period, determines the risk; therefore, separate CSFs are not derived for subchronic and chronic exposure periods. Table 5-19 presents the CSFs and UR_is used in this report. Target sites affected by the COCs and the USEPA cancer classifications of the COCs are also shown. The oral CSF is adjusted to evaluate dermal exposures (Table 5-19). This is done by dividing the oral CSF by the oral absorption efficiency. The oral and dermal absorption efficiencies are shown in Table 5-19, and the adjusted values are shown in Table 5-20. Table 5-22 presents the permeability coefficients for the groundwater COCs. Permeability constants are used to estimate the dermal intake for a receptor exposed to groundwater.

5.2.3 Toxic Effects Summary

Toxicity values for the COCs were identified in the previous section. COCs include seven carcinogenic PAHs, antimony, arsenic, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and zinc. This section presents a brief summary of the known toxic effects of the COCs and the basis for their toxicity values.

Most of the toxicity data derived from humans come from occupational, accidental, or intentional exposures. Epidemiological studies of human populations which are adequate to derive toxicity values are limited to a few chemicals. In most epidemiological studies, it is difficult to determine the exposure conditions (i.e., concentrations, frequency, duration, etc.); the number of exposed individuals is small; the incidence of the effect is small; and exposure to multiple chemicals may have occurred. Therefore, data derived from laboratory animal studies frequently are used to extrapolate potential risks to humans. Although reliance on laboratory animal studies increases the uncertainty associated with risk estimates, modern toxicology is built on the premise that the toxic effects of chemical agents are similar for laboratory animals and humans. The weight of evidence increases when similar results are observed in both sexes, more than one species of laboratory animal, across various routes of exposure, and case reports from human exposures.

5.2.3.1 Acetone

Acetone is a clear, colorless, highly flammable liquid which is commonly used as a solvent and chemical intermediate, and is also found in some consumer products such as nail polish remover (Agency for Toxic Substances and Disease Registry [ATSDR], 1994). Acetone is also a natural metabolic byproduct found in and released from plants and animals.

Acetone can be absorbed through the lungs, digestive tract, and the skin (Morgott, 1993). It is rapidly transported throughout the body and is not preferentially stored in any body tissue (Morgott, 1993). The liver is the major organ of acetone metabolism, and excretion occurs mainly through the lungs and in the urine.

Acute toxic effects following ingestion of 50 milliliter (mL) or more may include ataxia, sedation, and coma; respiratory depression; gastrointestinal disorders (vomiting and hematemesis); hyperglycemia and ketonemia; acidosis; and hepatic and renal lesions (Krasavage et al., 1982). Ingestion of 10–20 mL (7.9–15.8 grams [g]) generally is not toxic (Hazardous Substances Database [HSDB], 1995), and consumption of 20 grams per day (g/day) for several days resulted in only slight drowsiness (Morgott, 1993). The minimum lethal dose for a 150-pound person is estimated to be 100 mL (79.1 g). No information is available on the subchronic or chronic oral toxicity to humans. In animal studies, subchronic oral exposures were associated with kidney damage and hematological changes.

The RfD for chronic oral exposures, 0.1 milligrams per kilogram-day (mg/kg-day), is based on increased liver and kidney weights and nephrotoxicity in rats (IRIS, 2000). The NOAEL for this study was 100 mg/kg/day, and the LOAEL was 500 mg/kg/day (IRIS, 2000). The subchronic oral RfD of 1 mg/kg/day (USEPA, 1997b) is based on the same rodent study.

A RfC has not been derived for acetone (IRIS, 2000). Information on the inhalation toxicity of acetone to humans is derived from occupational and laboratory studies. Typical symptoms of inhalation exposure are central nervous system depression and irritation of the mucous membranes of the eyes, nose, and throat (Morgott, 1993). Central nervous system effects can range from subtle neurobehavioral changes to narcosis depending on the magnitude and length of exposure. Neurobehavioral changes have been reported at concentrations as low as 237 parts per million (ppm) (574 milligrams per cubic meter [mg/m^3]) (ATSDR, 1994). Irritant effects have been reported at concentrations of 500 ppm (1210 mg/m^3) and higher. Extremely high concentrations (greater than 29 grams per cubic meter [g/m^3]) can cause dizziness, confusion, unsteadiness, and unconsciousness (ATSDR, 1994). Prolonged occupational exposures to acetone vapors have not been associated with chronic systemic disorders (Morgott, 1993). Little information is available on subchronic or chronic inhalation toxicity in animals.

Animal data indicate that acetone is not teratogenic; however, adverse reproductive effects may occur at high concentrations. Drinking water concentrations equal to doses greater than 3 grams per kilogram-day (g/kg-day) during pregnancy were associated with spermatogenic effects, reduced reproductive index, and decreased pup survival of rodents (ATSDR, 1994). Inhalation exposure to 11,000 ppm resulted in reduction in maternal body weight gain, a decrease in uterine and extragestational weight gain, and a significant reduction in fetal weight of rats but no adverse effects on reproduction or development (Mast et al., 1988). In the latter study, the incidence of malformations was not increased by exposure to acetone.

No evidence is available that suggests acetone is carcinogenic in humans or animals (Morgott, 1993). Negative results have been reported in occupational exposure studies and in rodent skin painting studies. Although acetone has not been tested in a 2-year rodent bioassay, in vitro tests for mutagenicity, chromosome damage, and deoxyribonucleic acid (DNA) interaction indicate that acetone is not genotoxic except under severe conditions (Morgott, 1993). Acetone is classified by USEPA in weight-of-evidence Group D, not classifiable as to human carcinogenicity (IRIS, 2000).

5.2.3.2 Benzene

Benzene is a clear, volatile, highly flammable, aromatic hydrocarbon, which exists naturally in the environment, and is produced by volcanoes and forest fires. Benzene is also a common industrial solvent, used as a solvent for fats, inks, paints, plastics, rubber, in the extraction of oils from seeds and nuts, in photogravure printing, as a chemical intermediate and in the manufacture of detergents, explosives, pharmaceuticals and dyestuffs. It is also a component of gasoline and other petroleum-based fuels (ATSDR, 1989).

Benzene targets its effects on the hemopoietic, immune and nervous systems (ATSDR, 1989). Exposure to benzene has produced irritation of the skin, eyes and upper respiratory tract. Acute exposure has produced central nervous system depression, headache, dizziness, nausea, convulsions, coma and death at extremely high concentrations (Sittig, 1981). Health effects in humans have been reported starting as low as 50 ppm via inhalation. Twenty-five ppm for 6 hrs had no obvious effects though benzene was detected in blood (Sandmeyer, 1981). Early autopsy reports found benzene-induced hemorrhages of the brain, pericardium, urinary tract, mucous membranes and skin (Sittig, 1981). Chronic exposure to benzene produces blood changes involving an initial increase in levels of erythrocytes, leukocytes and thrombocytes, followed by aplastic anemia indicated by anemia, leukopenia and thrombocytopenia (Sittig, 1981).

The following effects have been produced experimentally in laboratory animals, following exposure to benzene: decreased leukocyte and/or erythrocyte counts, reduction in cellular immunity and bone marrow depression (reduced number of granulopoietic stem cells). Animal studies do not indicate that benzene is teratogenic, but the following fetotoxic effects have been found: reduced fetal weight, altered fetal hematopoiesis, fetal skeletal variations and increased resorptions in pregnant exposed animals. In addition, benzene has produced histopathological changes in ovaries and testes of test animals (ATSDR, 1989).

Benzene and its metabolites have been shown to be mutagenic in a number of in vitro and in vivo studies. Genotoxic effects produced experimentally include structural and numerical chromosome aberrations in humans, animals and cell cultures, and sister chromatid exchanges and micronuclei in vivo animal studies. Benzene exposure has been found to produce an increase in the number of chromosome aberrations associated with myelotoxicity (Sittig, 1981). In addition, sperm head abnormalities, inhibition of DNA and ribonucleic acid (RNA) synthesis, DNA binding and interference with cell cycle progression have been shown in in vitro studies (ATSDR, 1989). The epidemiological data indicate that benzene is leukemogenic. The evidence is most convincing for acute myelogenous and acute erythroleukemia, although a correlation has also been found with chronic leukemia. Benzene has been designated a group A human carcinogen (leukemogen) by inhalation. Although data are insufficient to validate the carcinogenicity of benzene via ingestion, it would not be unreasonable that benzene is carcinogenic via this route as well if present in sufficient quantities. The carcinogenicity of benzene via dermal exposure is considered to be lower since benzene is absorbed poorly through the skin (ATSDR, 1989).

5.2.3.3 Trichloroethene

Trichloroethene is widely used as an industrial solvent, particularly in metal degreasing operations. Trichloroethene is also used for dry-cleaning, as a low-temperature heat exchange fluid, as a fumigant, as a diluent in paints and adhesives, in aerospace operations, and in textile processing.

Absorption of trichloroethene from the gastrointestinal and respiratory tracts is extensive. Although the liver is the primary site of trichloroethene metabolism, there is evidence for extrahepatic metabolism in the lungs and kidneys (ATSDR, 1988).

Trichloroethene exposure is assumed to be responsible for the deaths of four men employed at a degreasing operations facility (Kleinfeld and Tabershaw, 1954). Toxicological analysis revealed trichloroethene in varying concentrations in several tissues. Short-term exposure to high concentrations of trichloroethene produces dizziness, headache, nausea, confusion, facial numbness, blurred vision, and, at very high levels, unconsciousness (ATSDR, 1988). Longer exposures cause ataxia, decreased appetite, sleep disturbances, and trigeminal neuropathy (IRIS, 2000). Information regarding hepatotoxicity in humans is limited and derived from acute overexposures.

In laboratory animals, the acute toxicity of trichloroethene is low. A subchronic study in rats conducted by the National Toxicology Program (NTP) (1986) showed decreased survival due to trichloroethene treatment. Deaths were attributed to toxic nephrosis. Liver enlargement is the most commonly observed hepatic effect seen in trichloroethene-exposed animals (Kjellstrand et al., 1983). Mice, especially males, appear to be particularly sensitive to the hepatotoxic effects of trichloroethene.

Trichloroethene has been shown to be carcinogenic in animals. Inhalation and oral exposure produced liver and lung tumors in mice and kidney adenocarcinomas, testicular Leydig cell tumors, and possibly leukemia in rats. These studies are deemed sufficient to place trichloroethene in classification B2, probable human carcinogen (IRIS, 2000). Further support that trichloroethene is a probable human carcinogen comes from studies that indicate that metabolism is qualitatively similar in humans and test animals (USEPA, 1987).

5.2.3.4 PAHs

PAHs are found throughout the environment from both natural and anthropogenic (man-made) sources. These compounds are closely related chemically and have similar toxic effects; however, not all of the PAHs are thought to be carcinogenic. Benzo(a)pyrene is the only carcinogenic PAH for which the USEPA has developed a CSF (IRIS, 2000). The current recommendation from USEPA is to estimate risk for other PAHs based on structure-activity relationships relative to benzo(a)pyrene. The risk estimates are conducted by converting the CSF and UR_i for benzo(a)pyrene by a toxicity equivalency factory (TEF). Although several epidemiological studies have linked human exposure to mixtures of PAHs containing benzo(a)pyrene to lung cancer, the studies are not sufficient to determine that benzo(a)pyrene or any other PAH is responsible.

Numerous animal studies have been conducted to investigate the carcinogenicity of benzo(a)pyrene. These include exposure via inhalation, dietary, gavage, and dermal contact with guinea pigs, hamsters, rats, mice, and several primates. Tumors generally are produced at the site of administration; however, tumors at distant sites have been reported (IRIS, 2000). The most common tumor sites include the stomach, lungs, and skin. The current oral CSF of 7.3 kilogram-day per milligram (kg-day/mg) is based on the geometric mean of slope factors derived from four studies (IRIS, 2000). The National Center for Environmental Assessment provided a UR_i of 0.00088 cubic meters per microgram ($m^3/\mu g$) (USEPA, 1999).

An RfD has not been derived for the carcinogenic PAHs. However, the RfD for pyrene can be used as a surrogate. Reported noncarcinogenic effects of PAHs in laboratory animals include dermatitis, skin sensitization to sunlight, immunosuppression, reproductive and developmental effects, liver, kidney, and gastrointestinal tract at concentrations ranging from 10 mg/kg/day to more than 100 mg/kg/day (ATSDR, 1989). The naphthalene RfD can be used as a surrogate toxicity value for non-carcinogenic PAHs for which RfDs have not been derived.

5.2.3.5 Antimony

Antimony production has been associated with an increase in lung cancer among exposed workers (National Institute for Occupational Safety and Health [NIOSH], 1978), and one inhalation study in rats also indicated that antimony trioxide might produce lung and liver tumors (American Conference of Governmental Industrial Hygienists [ACGIH], 1980; USEPA, 1980). Several studies in bacterial test systems report that various antimony compounds, including antimony trioxide, antimony trichloride, and antimony pentachloride, may be mutagenic. Reports of effects on reproduction are limited. Among the effects on reproduction reported for humans is impairment of the female reproductive system. Female workers exposed to metallic antimony dust, antimony trioxide, and antimony pentoxide had an increased incidence of gynecological disorders and late spontaneous abortions. Antimony was found in the breast milk, placental tissue, amniotic fluid, and blood of the umbilical cord in exposed workers. Decreased weight gain was observed in children born of workers exposed to antimony. The same paper reports a study in which intraperitoneal administration of antimony produced changes in rats that support the findings of human reproductive effects.

Cardiovascular changes associated with exposure to antimony represent a serious health effect (IRIS, 2000). Exposure to either trivalent or pentavalent antimonial compounds can produce electrocardiogram (ECG) changes in humans. Histopathological evidence of cardiac edema, myocardial fibrosis, and other signs of myocardial structural damage indicates that antimony may produce even more severe, possibly permanent, myocardial damage in humans (IRIS, 2000). Parallel findings of functional changes in ECG patterns and of histopathological evidence of myocardial structural damage have also been obtained in animal toxicity studies. Pneumoconiosis in response to inhalation exposure and dermatitis in response to skin exposure also may have been observed among individuals exposed to antimony or its compounds (ATSDR, 1997).

USEPA (IRIS, 2000) calculated an oral RfD of 0.0004 mg/kg/day based on a study showing altered blood chemistry and decreased lifespans in rats exposed to antimony via drinking water. A NOAEL was not identified in this study, and the LOAEL was identified at 0.35 mg/kg/day (IRIS, 2000).

5.2.3.6 Arsenic

Arsenic is a naturally-occurring element and may be found in soil, water, food, and air. Normal, or background, exposure from these sources is estimated at about 50 micrograms per day (μg/day). Food is the largest background source under most circumstances. Ingestion of as little as 50 mg to 300 mg can be fatal to humans. Lower levels have caused gastrointestinal distress (nausea, vomiting, and diarrhea), loss of appetite, hair and weight loss, and irritation of mucous membranes. Long-term exposure to arsenic is known to cause damage to the nervous system, blood vessels, and skin. Arsenic is known to be a human carcinogen. Cancer of the skin, lungs, liver, kidney, and bladder have been associated with human exposures to arsenic. Arsenic has not been shown to be carcinogenic in laboratory animals. An oral RfD, oral CSF, and UR_i have been developed by USEPA (IRIS, 2000). All of the toxicity values were based on human epidemiological studies.

The oral RfD was developed from a study of Taiwanese populations exposed to naturally-occurring arsenic in water-supply wells. The mean concentration of arsenic in the low-dose group was 9 μg/L and was identified as the NOAEL (IRIS, 2000). The mean arsenic concentration in the LOAEL group was 170 μg/L. The most sensitive effects included darkening of the skin, thickening of the skin of the palms and soles, and the appearance of "corns" or "warts" on the hands, feet, and body. In extreme cases, blood vessel damage may lead to gangrene of the feet (called blackfoot disease). Based on an assumed water consumption rate of 4.5 liters per day (L/day), background exposure to 0.002 mg of arsenic per day in food, and an average body weight of 55 kilograms (kg), the arsenic concentration in the NOAEL group was converted to 0.0008 mg/kg/day and divided by an uncertainty factor of 3 to derive the RfD of 0.0003 mg/kg/day (IRIS, 2000). The uncertainty factor of 3 was selected to account for the lack of data on reproductive effects and to account for individuals who may be more sensitive than those included in the study. Overall, the USEPA has assigned a medium confidence level to the RfD. Although more than 40,000 people were included in the study, exposures were not well characterized and other contaminants were present.

Arsenic is a Class A, known human carcinogen (IRIS, 2000). The oral CSF for arsenic was based on the same epidemiological studies as the RfD, and skin cancer was the tumor type evaluated. The UR_i was derived from epidemiological studies of smelter workers which showed a statistically increased incidence of lung cancer in these workers.

5.2.3.7 Barium

The soluble salts of barium, an alkaline earth metal, are toxic in mammalian systems. They are absorbed rapidly from the gastrointestinal tract and are deposited in the muscles, lungs, and bone (ATSDR, 1997). At low doses, barium acts as a muscle stimulant and at higher doses affects the nervous system eventually leading to paralysis. Acute and subchronic oral doses of barium can cause vomiting and diarrhea, followed by decreased heart rate and elevated blood pressure (IRIS, 2000). Higher doses result in cardiac irregularities, weakness, tremors, anxiety, and dyspnea (IRIS, 2000). Death can occur from cardiac and respiratory failure. Acute doses of approximately 0.8 grams can be fatal to humans.

Subchronic and chronic oral or inhalation exposure primarily affects the cardiovascular system resulting in elevated blood pressure. A LOAEL of 0.51 mg barium/kg/day based on increased blood pressure was observed in chronic oral rat studies, whereas human studies identified a (NOAEL of 0.21 mg barium/kg/day (IRIS, 2000). The human data were used by the USEPA to calculate a chronic and subchronic oral RfD of 0.07 mg/kg/day (IRIS, 2000). Confidence in the oral RfD is rated medium by the USEPA.

Subchronic and chronic inhalation exposure of human populations to barium-containing dust can result in a benign pneumoconiosis called "baritosis." This condition is often accompanied by an elevated blood pressure but does not result in a change in pulmonary function. Exposure to an air concentration of 5.2 mg barium carbonate/m^3 for 4 hours/day for 6 months has been reported to result in elevated blood pressure and decreased body weight gain in rats (IRIS, 2000). Reproduction and developmental effects were also observed. Increased fetal mortality was seen after untreated females were mated with males exposed to 5.2 mg/m^3 of barium carbonate. Similar results were obtained with female rats treated with 13.4 mg barium carbonate/m^3. The NOAEL for developmental effects was 1.15 mg/m^3 (equivalent to 0.8 mg barium/m^3). A RfC of 0.005

mg/m^3 for subchronic and 0.0005 mg/m^3 for chronic exposure was calculated by the USEPA based on the NOAEL for developmental effects (IRIS, 2000). These effects have not been substantiated in humans or other animal systems.

Under EPA's 1986 Guidelines for Carcinogen Risk Assessment, barium would be classified as Group D, not classifiable as to human carcinogenicity. Although adequate chronic oral exposure studies in rats and mice have not demonstrated carcinogenic effects, the lack of adequate inhalation studies precludes assessing the carcinogenic potential of inhaled barium. Under the Proposed Guidelines for Carcinogenic Risk Assessment (USEPA, 1996c), barium is considered not likely to be carcinogenic to humans following oral exposure and its carcinogenic potential cannot be determined following inhalation exposure

5.2.3.8 Cadmium

Cadmium is a naturally occurring mineral in the earth's crust. Cadmium bioaccumulates in humans, particularly in the kidney and liver (USEPA, 1985). Chronic oral or inhalation exposure of humans to cadmium has been associated with renal dysfunction, itai-itai disease (bone damage), hypertension, anemia, endocrine alterations, and immunosuppression. Renal toxicity occurs in humans at a renal cortex concentration of cadmium of 200 micrograms pei gram (µg/g) (USEPA, 1985).

The USEPA considers cadmium a Class B1, probable human carcinogen. In experimental animals, cadmium induces injection-site sarcomas and testicular tumors. When administered by inhalation, cadmium chloride is a potent pulmonary carcinogen in rats. Cadmium is a well documented animal teratogen (USEPA, 1985).

USEPA (IRIS, 2000) has classified cadmium as a B1 agent (probable human carcinogen). This classification applies to agents for which there is limited evidence of carcinogenicity in humans from epidemiological studies. UR_i of 0.0018 $m^3/\mu g$ has been derived from cadmium based on epidemiological studies. Using renal toxicity as an endpoint, an RfD of 1 x 10^{-3} mg/kg/day has been derived (IRIS, 2000) for exposures to cadmium in soil.

5.2.3.9 Chromium

The toxicity of chromium depends on the valence state of the compound. Hexavalent chromium is more toxic than trivalent chromium, which is an essential nutrient for fat and sugar metabolism. Ingestion of large amounts of hexavalent chromium salts can damage the digestive tract, kidneys, and liver. Occupational exposure to hexavalent chromium has been associated with lung cancer, skin ulceration, allergic dermatitis, and anemia. Laboratory studies also indicate that hexavalent chromium is mutagenic. Trivalent chromium does not cause these effects. As a conservative measure, all chromium is assumed to be hexavalent in this risk assessment. Toxicity values discussed below apply to hexavalent chromium.

The RfD was derived from a 1-year drinking study in rats. The NOAEL was 2.4 mg/kg/day (derived from a concentration of 25 mg/L of potassium chromate in drinking water). No concentrations higher than 25 mg/L were given; therefore, a LOAEL was not identified. An uncertainty factor of 500 was used to derive the RfD of 0.003 mg/kg/day. Factors of 10 were used to compensate for interhuman and interspecies variability in sensitivity, and a factor of 5 was used to compensate for less than lifetime exposure. Confidence in the RfD was rated as low because of the small number of animals used in the study, small number of parameters measured, failure to identify a LOAEL, poor quality of supporting studies, and insufficient data for teratogenic or reproductive endpoints.

Inhalation of hexavalent chromium compounds may cause lung cancer; however, ingested hexavalent chromium is not considered to be carcinogenic. The inhalation unit risk factor of 1.2 × 10^{-2} $m^3/\mu g$ was derived from occupational epidemiological studies.

Dose-response relationships for chromium exposure and lung cancer have been consistent across several studies (IRIS, 2000).

5.2.3.10 Cyanide

The oral RfD of 0.02 mg/kg/day for cyanide was based on a two year dietary study with rats by Howard and Hanzal (IRIS, 2000). The critical effects noted in the study were weight loss, thyroid effects, and myelin degeneration. The NOAEL was set at 10.8 mg/kg/day and the LOAEL was 30 mg/kg/day. The uncertainty factor of 100 was applied to the derivation of the RfD to account for interspecies extrapolation and for sensitive populations. An additional modifying factor of 5 was applied to account for the tolerance to cyanide when it is ingested with food rather than when it is administered by gavage or drinking water.

An inhalation RfC has not been developed for cyanide, but since it is metabolized extensively in the liver, which indicates that the inhalation route may not be as important for toxicity as the oral route of administration (IRIS, 2000).

In vitro studies of cyanide's genotoxicity have been negative except for a marginally mutagenic response for hydrogen cyanide in one Salmonella strain (IRIS, 2000). This response was decreased in the presence of rat hepatic homogenates. The USEPA has placed cyanide in the weigh-of-evidence category D; not classifiable as a human carcinogen.

5.2.3.11 Lead

Lead is known to cause many toxic effects depending on the exposure circumstances. The principal toxic effects include damage to the nervous system, blood-forming system, kidneys, and reproductive system. Some lead compounds have caused kidney cancer in rats and mice; however, data are insufficient to determine if lead causes cancer in humans. The fetus and young children are particularly susceptible to lead because of greater absorption and sensitivity of the developing nervous system. Lead exposure can cause decreased mental ability, premature birth, and reduced growth rates in children. For adults, an increase in blood pressure is one of the most sensitive effects.

Risk assessment for lead does not rely on the standard toxicity values (RfDs and CSFs); instead, the USEPA (1996b) has developed various models which are used to predict levels of lead in the blood following various exposures. These models were designed to protect the fetus and young children as the most sensitive receptors. Current data indicate that children may be affected by lead at blood lead levels of 10 micrograms per deciliter of blood (µg/dL) or lower. Severe brain damage, anemia, and kidney damage can occur when blood lead levels exceed 80 µg/dL in children or 80 to 100 µg/dL in adults (Goyer, 1991). Damage to the peripheral nervous system can occur at concentrations of 40 µg/dL, and concentrations greater than 30 µg/dL may permanently lower intelligence quotient (I.Q.) scores of children. The nervous system of the developing fetus may be damaged at concentrations in the 10 to 15 µg/dL range.

5.2.3.12 Mercury

In humans, elemental and inorganic mercury are absorbed following inhalation exposure but are poorly absorbed following oral exposure (ATSDR, 1997). Occupational exposure of workers to elemental mercury vapors (0.1 to 0.2 mg/m^3) has been associated with mental disturbances, tremors, and gingivitis (ATSDR, 1997). The central nervous system is a major target for organic mercury compounds. Adverse effects in humans from exposure to organic mercury compounds have included destruction of cortical cerebral neurons, damage to Purkinje cells, and lesions of the cerebellum. Clinical symptoms following exposure to organic mercury compounds have included paresthesia, loss of sensation in extremities, ataxia, and hearing and visual impairment (World Health Organization [WHO], 1976). A primary target organ for inorganic compounds is the kidney. Human exposure to inorganic mercury compounds has been associated with anuria, polyuria, proteinuria, and renal lesions (Hammond and Beliles, 1980). Embryotoxic and teratogenic effects, including malformations of the skeletal and genitourinary systems, have been observed in animals exposed to organic mercury (ATSDR, 1997). Both organic and inorganic compounds are reported to be genotoxic in eukaryotic systems (Leonard et al., 1984).

USEPA has categorized mercury as a Class D chemical, i.e., not classifiable as to human carcinogenicity. This classification applies to those agents for which there is inadequate evidence of carcinogenicity in animals. The RfD for inorganic mercury is under review by USEPA. The inhalation RfC for inorganic mercury is 3×10^{-4} mg/m^3 (IRIS, 2000).

5.2.3.13 Nickel

Nickel from refinery dust has been classified as a Class A human carcinogen by the USEPA. Numerous studies have proven a statistically significant increase in nasal and lung cancers for workers exposed to nickel dust. Although animal studies have not been as conclusive (some species of rats and mice show no response), some studies have shown increased incidents of sarcomas. The inhalation UR_i for nickel as refinery dust is 2.4×10^{-4} m^3/µg (IRIS, 2000). The oral RfD for nickel is based on decreased body weight for rats exposed to nickel (as soluble salts). An uncertainty factor of 300 is related with the oral RfD of 0.02 mg/kg/day, and confidence is medium (IRIS, 2000).

5.2.3.14 Selenium

Selenium is an essential micronutrient, and both high doses and deficiencies of selenium have been shown to produce adverse effects (IRIS, 2000). In the United States, selenium in most diets is usually enough to meet the daily requirement of this essential metal. In regions of China where soil levels of selenium are very low, diets lacking selenium have resulted in heart problems and muscle pain (ATSDR, 1997). Selenium compounds can be harmful at daily dietary levels 5–10 times higher than the daily requirement (ATSDR, 1997).

There is no evidence that selenium is carcinogenic in humans (IRIS, 2000). Selenium has been tested by the oral route in experimental animals, but the available data are insufficient to allow unequivocal evaluation of its carcinogenic potential (IRIS, 2000). However, recent reports suggest that selenium is not carcinogenic. Several studies have shown that selenium may actually reduce the incidence of tumors under certain conditions (IRIS, 2000). The USEPA has classified selenium as a Group D—not classifiable as a human carcinogen.

Selenium is an essential element in animals and humans (ATSDR, 1997). However, exposure to amounts only slightly above the required levels can produce acute and chronic toxic effects. Acute toxicities of selenium compounds vary greatly, while the chronic effects of most forms are similar. Acute effects include degeneration of the liver, kidneys, and myocaria; hemorrhages in the digestive tract; and brain damage. Eye, nose, and throat irritation also may occur with inhalation exposure. The acute oral LD_{50} (i.e., dosage needed to produce death in 50 percent of the treated animals) value of sodium selenite in rats was approximately 10 mg/kg. Chronic toxicity in humans appears to occur only in areas where foods containing excessive concentrations of selenium are ingested. Signs of chronic selenium intoxication include central nervous system (CNS) effects such as depression, nervousness, peripheral anesthesia, and pain in the extremities; dermatitis; gastrointestinal disturbances; dental discoloration; lassitude; and partial loss of hair and nails (IRIS, 2000).

5.2.3.15 Silver

Silver is used in photographic materials, batteries, paints and jewelry. Silver also has several medical uses, including as a dental amalgam and in medical supplies for burn treatment. Photographic materials are the major source of silver that is released into the environment (ATSDR, 1990).

Studies in humans and animals indicate that silver compounds are absorbed readily by the inhalation and oral routes. Individuals and individual organs absorb silver selectively. The greatest concentrations are found in the reticuloendothelial organs (ATSDR, 1990).

Blue-gray discoloration of the skin has been observed in many individuals who have ingested metallic silver and silver compounds over periods of months to years. This condition is termed argyria. However, this pigment discoloration is not known to be diagnostic of any other toxic effect (ATSDR, 1990). Occupational exposure to silver dusts can lead to respiratory and gastrointestinal irritation. Symptoms included abdominal pain, sneezing, stuffiness, and sore throat. Granular deposits were also observed in the conjunctiva and corneas of the eyes (Rosenman et al., 1979; 1987). Medical case histories indicate that dermal exposure to silver and silver compounds for extended periods of time can lead to local skin discoloration similar in nature to the generalized pigmentation seen after repeated oral exposure. The amount of silver and the duration of exposure necessary to produce this effect have not been established (McMahon and Bergfeld, 1983).

The oral RfD of 0.005 mg/kg/day was based on a human study, where silver was introduced intravenously for 2 to 9 years (IRIS, 2000). The critical effect was argyria, and the LOAEL was 0.014 mg/kg/day. No NOAEL was established by this study (IRIS, 2000).

Silver is not mutagenic in bacteria but it has been found to cause DNA damage in mammalian cell culture (Robinson et al., 1982). Despite frequent use of silver as a therapeutic agent, there has been no reported evidence of cancer in humans has been reported. No studies were located regarding cancer in humans or animals following oral, inhalation or dermal exposure to silver or silver compounds (ATSDR, 1990). The USEPA has grouped silver in the Group D—not classifiable as to human carcinogenicity.

5.2.3.16 Zinc

Zinc is an essential nutrient, with a recommended daily allowance of 5 to 15 milligrams per day (mg/day). However, large doses seem to produce copper deficiency anemia. A 10-week study of women taking 50 mg Zinc/day resulted in a decrease of erythrocyte superoxide dismutase (ESOD), a decline in ferritin and hematocrit values, and an increase in zinc serum (IRIS, 2000). The same study in men also showed a decrease in ESOD. People with sickle cell anemia exposed to zinc experience copper deficiency. Zinc does seem to lower high density lipid (HDL) cholesterol (IRIS, 2000).

Carcinogenic studies for zinc are inadequate, and the USEPA has identified zinc as not classifiable as to human carcinogenicity (Group D). Some laboratory studies indicate an increase in hepatomas in mice exposed to zinc in drinking water. Some fowl have developed testicular testoma when injected with 0.01 grams (g) of zinc acetate or zinc stearate (IRIS, 2000).

5.3 EXPOSURE ASSESSMENT

Exposure assessments typically rely on standard default assumptions developed by USEPA or state regulatory agencies because actual exposure data typically are not available and are difficult to obtain. Because of this fact, there is a great deal of uncertainty associated with exposure estimates. In order to compensate for this uncertainty, reasonable maximum exposure (RME) assumptions are used. The RME is defined as the maximum exposure that is reasonably expected to occur at the site; therefore, actual exposures are likely to be less than the RME. Standard default exposure assumptions have been developed for residential and industrial exposure scenarios.

However, site-specific data and professional judgment also are important components of the exposure assessment. Both were incorporated in the risk assessment.

5.3.1 Exposure Setting

SWMU 23 was used to store waste materials from the BTF and Chemical Manufacturing Plant; SWMUs 24 and 39 were used to store waste materials from the former Blast Furnace Plant; and SWMU 38 was used to store construction debris, soil from excavation activities, and other debris. The SWMUs are in a relatively isolated portion of the entire facility. Activities at the Land Disposal Areas range from waste moving to nothing. SWMU 23 is not visited on a regular basis by Sloss workers. The use of these SWMUs is not expected to change for the foreseeable future. Activity on the site is limited to site workers, and site access is controlled by a locked gate and 24-hour guard. The surrounding property is mixed industrial and residential. Groundwater is not used as a water supply on the site or in the site vicinity. Surface water on the site is limited to a drainage ditch along the eastern property boundary; storm water drainage ditches along Summit Street, the polishing pond (SWMU 22) just north of SWMU 24; and the Stormwater Runoff Sewer (SWMU 25) west of SWMU 38. SWMUs 22 and 25 will be investigated as part of the BTF and Sewers RFI.

5.3.2 Conceptual Site Exposure Model

The conceptual site exposure model provides the framework of the risk assessment. It characterizes the exposure setting, identifies sources and transport pathways for the COCs, identifies potential receptors for current and future land uses, and identifies the primary exposure routes (Figure 5-1). Receptors may include any living organism (human, plant, or animal). Exposure routes include the basic pathways through which a COC may be absorbed (inhalation, oral ingestion, or dermal contact).

An exposure pathway evaluation is a key component of a risk-based analysis. Exposure can occur only when the potential exists for a receptor to directly contact released constituents or if there is a mechanism for released constituents to be transported to a receptor. Each component (released constituents, mechanism of transport, point of contact, and presence of a receptor) must be present for a complete exposure pathway.

This report focuses on the SWMUs (23, 24, 38 and 39) associated with the Land Disposal Areas that are located at the northern portion of the Sloss facility. The Sloss Facility currently manufactures foundry and furnace coke through the process of carbonization at the Coke Manufacturing Plant, TSA and BSC at the Chemical Manufacturing Plant, and mineral wool. Access is controlled by a fence and gate which is manned by security guards 24 hours per day.

SWMUs in the Land Disposal Areas are not used currently, and there are no plans to reuse these portions of the Sloss property. SWMU 23 is isolated and overgrown; no one contacts the material stored there. The sludge from SWMU 24 is being mined and sold as product and SWMU 39 will be mined in the future. A metals recovery operation was performed on SWMU 38 and the landfill is still being used for disposal of construction debris and soil from excavation activities. Site workers, including construction or excavation workers and potential trespassers (assuming that access to the site is not controlled any longer), may be exposed to COCs in surface soils, subsurface soil, sludge, and ambient air. Incidental ingestion, dermal contact, and inhalation of dust and vapors are the exposure routes. It was conservatively assumed that construction or excavation workers could also come into contact with groundwater constituents during construction activities. Dermal contact, inhalation of volatiles, and incidental ingestion of groundwater were the exposure routes assessed for this receptor. Off-site transport of the COCs is expected to be minimal compared with on-site concentrations; therefore, on-site workers represent the receptors with the greatest exposure potential.

Groundwater is not used as a potable water supply at the site or in the surrounding area. Nonetheless, exposure to groundwater used a drinking water source is evaluated in this risk assessment although there is no opportunity for this to be a complete exposure route. The area is supplied with water by the municipal water district.

5.3.2.1 Release Sources and Release Mechanisms

The release sources and release mechanisms can be divided into two groups: primary and secondary. Primary release sources are those sources that initially release the COC(s). Secondary release sources are those sources that were impacted by the primary source and can cause an additional release of the COC(s). Potential release sources include the SWMUs identified at the Land Disposal Areas.

The soil and sludge from each SWMU are potential sources of release to the air and surrounding soil. Particulates and vapors that contain the COCs from operations are released into the atmosphere where they then have the potential of settling to the surface soil or may be transported off-site. Surface soil usually is defined as the soil between land surface and 1 ft bls. Once in the surface soil the COC may either migrate into the subsurface soil and subsequently leach into the groundwater or be released via vapors and dust into the atmosphere. The concentrations of constituents detected in groundwater are relatively low, indicating the subsurface migration to groundwater pathway is not significant. The physical and chemical properties influencing constituent migration are presented in Table 5-23.

5.3.2.2 Exposure Points, Exposure Routes, and Receptors

Exposure points are the specific locations where a receptor may contact constituents in soil, groundwater, or other environmental media. Impacted surface and subsurface soil, sludge, and groundwater at the Land Disposal Areas are the exposure points. There are no water-supply wells within the vicinity of the site. The residential area located next to the facility is on a municipal water supply; therefore, it is highly unlikely that the shallow groundwater would ever be used as a water supply in the future near the site. As a conservative assumption, it was assumed that the groundwater at the Land Disposal Areas would be used as a water supply. Therefore, domestic use of groundwater by residents is considered an exposure pathway of interest for the Land Disposal Areas.

It is anticipated that on-site exposure routes under current and future conditions will be limited to site workers. Exposure routes examined include incidental ingestion, dermal contact, and inhalation of dusts and vapors.

If construction projects are conducted on the site in the future, contact with subsurface soil in the SWMUs could occur. It was conservatively assumed that the excavation workers could be exposed to the shallow groundwater.

Off-site residents may be exposed to the constituents in soil via inhalation. Due to the distance to the nearest residence and the expected low releases to air due to the extensive cover over the area, off-site residential exposure is expected to be minimal compared to potential on-site worker exposure. Therefore, off-site resident inhalation is not considered an exposure pathway of concern for the Land Disposal Areas.

Access to the site is currently restricted so that unauthorized persons are not expected to gain site access. However, in the event that site access is not so strictly controlled in the future, a trespasser scenario was also evaluated. It was assumed that a older child (age 6 - 17 years) might come into contact with surface soils at the site while walking across the property.

The potential exists for birds and small terrestrial animals to be exposed to the COCs in soil via ingestion; however, the industrial nature of the site is a limiting factor for ecological receptors.

5.3.3 Exposure Assumptions

Standard exposure assumptions (USEPA, 1989b; 1996a) for industrial workers were used in this risk assessment for the Land Disposal Areas. These values are summarized in Table 5-24. No specific guidance has been developed regarding exposure frequency and exposure duration for an excavation worker. Therefore, professional judgment was used. The excavation worker exposure scenario is based on a construction project that lasts 18 weeks (90 working days). Work is conducted 8 hours per day, 5 days per week.

Site workers are assumed to come in contact with impacted surface soil (0 to 1 foot bls) and sludge in SWMU 24 and SWMUs 38 and 39 for 8 hours per day, 250 days per year, over a 25-year period (USEPA, 1989b; 1996a). Actual exposures under current conditions are expected to be much less than assumed in this risk assessment because workers do not spend 8 hours per day at either of the SWMUs. SWMU 23 is not active; therefore, site workers are assumed to come in contact with sludge in SWMU 23 only during periodic inspections of the SWMU. Inspections were assumed to last 2 hours per day, 12 days per year (once a month), over a 25-year period. The site workers also are assumed to drink water drawn from the impacted areas. As a conservative measure, the individual was assumed to ingest all their water during the exposure time of working day from the SWMU or SWMUs. As a conservative measure, it also was assumed that a residential drinking water well would be installed at SWMU 23 and SWMUs 38 and 39 where groundwater data are available.

The EPCs for surface soil, subsurface soil, sludge, and groundwater based on log-normal data distribution, are presented in Tables 5-1 through 5-8, as identified in the USEPA Region 4 (1996a) guidance. The physical-chemical properties used to evaluate exposure are included in Table 5-23. Table 5-25 presents equations used to evaluate exposure and risk from exposure to surface soil, subsurface soil, and sludge. The equations used to calculate exposure and risks from exposure of construction workers to groundwater are presented in Table 5-29.

5.4 RISK CHARACTERIZATION

Risk characterization summarizes and combines information from the toxicity assessment and exposure assessment to derive quantitative or qualitative risk estimates. Risk estimates for the Land Disposal Areas are discussed in the following section.

5.4.1 Non-Carcinogens

Quantitative estimates for non-carcinogenic effects are called HQs. The HQ is the ratio of the estimated average daily exposure dose and the RfD for oral and dermal exposures, and the ratio of the estimated air concentration and the RfC for inhalation exposures. An HQ greater than 1 indicates only that the estimated exposure exceeds the RfD or RfC. It does not provide the probability of an adverse effect. Although an HQ greater than 1 indicates that the estimated exposure dose for that constituent exceeds the RfD or RfC, it does not necessarily imply that adverse health effects will occur. It is important to remember that all RfDs and RfCs and, consequently HQs, are not equal. The basis for the RfD/RfC and the confidence level should be considered in risk management decisions. The HQs are added to derive the hazard index (HI). Current regulatory methodology (USEPA, 1989b; 1996a) advises summing HIs across exposure routes for all media at the site to derive a "Total Site Hazard Index." If the total HI exceeds 1, COCs may be grouped according to critical toxic effects, and HIs may be calculated separately for each effect (USEPA, 1989b; 1996a).

5.4.2 Carcinogens

Quantitative estimates for carcinogenic effects are obtained by calculating the excess lifetime cancer risk (ELCR). Estimated average daily doses, or intakes, for each constituent are averaged over the expected lifetime of 70 years. The ELCR, equal to the product of the exposure dose and CSF or air concentration and the UR_i, is estimated for each known, probable, or possible carcinogenic COC in each medium. The ELCR values provided in this report are an indication of the increased risk, above that applying to the general population, which may result from the exposure scenarios described in the Exposure Assessment section (Section 5.3). The risk estimate is considered to be an upperbound estimate; therefore, it is likely that the true risk is less than that predicted by the model. Current regulatory methodology assumes that ELCRs can be summed across routes of exposure and COCs to derive a "Total Site Risk" (USEPA, 1989b; 1996a). The USEPA has a defined a target ELCR range of 1×10^{-6} to 1×10^{-4} (USEPA, 1996a). Risk levels within or below this range generally do not require remediation.

5.4.3 RME Risk Estimates

Site worker and trespasser exposure was calculated for exposure to sludge for SWMUs 23, 24, and 39, and was calculated for exposure to surface soil for SWMU 24. Construction worker exposure was calculated for exposure to subsurface soil and groundwater at SWMU 23 and SWMUs 38 and 39. Site worker and residential exposure to groundwater used as a water supply was evaluated for SWMU 23 and SWMUs 38 and 39. Surface soil and sludge data were used to evaluate current exposure conditions for site workers, and subsurface soil data were used to evaluate future conditions for construction workers. The equations used in the calculations for soil and sludge are presented in Table 5-25. The equations used to calculate construction worker exposure and risks to groundwater are presented in Table 5-29. The equations used to calculate site worker and residential exposure to groundwater are provided in Table 5-31.

The ELCR and HI for site worker exposure to sludge in SWMU 23 (Table 5-26) were 5×10^{-6} and 0.006, respectively. The major contributor to the ELCR is benzo(a)pyrene. The ELCR and HI for construction worker exposure to subsurface soil in SWMU 23 (Table 5-27) were 8×10^{-7} and 0.1, respectively. Table 5-28 shows the calculated risks for the trespasser exposure to sludge at SWMU 23. The ELCR for this scenario is 8×10^{-6} and the HI is 0.02. The ELCR for site worker and trespasser exposures are within the target range of 1×10^{-6} to 1×10^{-4}, and the ELCR for construction worker exposure is below the target range. The HIs for all the exposure scenarios are below the target of 1.

Calculated risks for construction worker exposure to groundwater at SWMU 23 are presented in Table 5-30. None of the COCs in groundwater are carcinogenic by the applicable exposure routes, so there is no ELCR calculated for this scenario. The HI is 0.0004, which is well below the target of 1 for toxic effects.

The risks for site worker and residential exposure to groundwater are summarized in Tables 5-32 and 5-33, respectively, for SWMU 23. None of the COCs in SWMU 23 are carcinogenic by the applicable exposure route and therefore, an ELCR is not calculated. The HI for site workers is 0.007, which is well below the target of 1 for toxic effects. The HI for residential exposure is 0.4, also below the target of 1 for toxic effects.

The ELCR and HI for site worker exposure to surface soil in SWMU 24 (Table 5-34) were 1×10^{-5} and 0.02, respectively. The major contributor to the ELCR is benzo(a)pyrene. The ELCR and HI for site worker exposure to sludge in SWMU 24 (Table 5-35) were 2×10^{-10} and 0.07, respectively. The ELCR and HI for trespasser exposure to surface soil at SWMU 24 (Table 5-36) were 1×10^{-6}, and 0.01, respectively. The ELCR and HI for trespasser exposure to sludge at SWMU 24 (Table 5-37) were 8×10^{-13}, and 0.03, respectively. The ELCRs are within or less than the target range of 1×10^{-6} to 1×10^{-4}, and the HIs are below the target of 1.

The ELCR and HI for site worker exposure to sludge in SWMU 39 (Table 5-38) were 2×10^{-12} and 0.04, respectively. The ELCR and HI for trespasser exposure to sludge in SWMU 39 (Table 5-39) were 8×10^{-15} and 0.02, respectively. The ELCR for site worker exposure is below the target range of 1×10^{-6} to 1×10^{-4}, and the ELCR for a trespasser also is below the target range. The HIs for both site worker and trespasser exposures are below the target of 1.

The ELCR and HI for construction worker exposure to groundwater at SWMUs 38 and 39 are presented in Table 5-40. The ELCR is 2×10^{-9} and the HI is 0.002. Both the ELCR and HI for construction worker exposure to groundwater at SWMUs 38 and 39 are below the target values.

The calculated risks for site worker and residential exposure to groundwater at SWMUs 38 and 39 are summarized in Tables 41 and 42, respectively. The ELCR and HI for the site worker are 1×10^{-6} and 0.4, respectively. The ELCR is at the low end of the USEPA target risk range and the HI is below the target value of 1. The ELCR for residential exposure is 1×10^{-5} and the HI for residential exposure it 1. The ELCR is within the USEPA target risk range and the HI is equal to the target value.

5.5 RISK-BASED REMEDIAL GOAL OPTIONS

Risk-based remedial goal options (RGOs) are provided in this section for the exposure scenarios where the ELCR exceeded 1×10^{-6}. RGOs for non-carcinogenic risks are unnecessary because all of the HQs and HIs were below 1. RGOs are presented at target risk levels corresponding to 10^{-4}, 10^{-5}, and 10^{-6} according to USEPA (1996a) guidelines. The RGO equations for soil and sludge exposures and a sample calculation are presented in Table 5-43. Table 5-44 includes the RGO equations and a sample calculation for groundwater exposures.

5.5.1 RGOs for Soil and Sludge Constituents

The calculated RGOs for site worker and trespasser exposure to COCs in sludge in SWMU 23 are shown in Tables 5-45 and 5-46, respectively. In comparing the EPCs with the calculated RGOs for both scenarios (Tables 5-45 and 5-46), none of the constituent EPC concentrations exceeded the RGO at a 1×10^{-5} risk level. Only the benzo(a)pyrene EPC concentrations exceeded a 1×10^{-6} risk level at each site.

RGOs for COCs in surface soil at SWMU 24 and SWMUs 38 and 39 are presented in Table 5-47, with the exception of lead. EPCs for constituents in SWMU 24 and SWMUs 38 and 39 are included in the table. In comparing the EPCs with the calculated RGOs, none of the constituent EPC concentrations exceeded the RGO at a 1×10^{-5} risk level. The EPCs for benzo(a)pyrene and benzo(a)anthracene exceeded a 1×10^{-6} risk level at SWMU 24.

The benzo(a)pyrene EPC in SWMU 24 surface soil is 6.9 mg/kg, while the RGO for site worker exposure is 0.76 mg/kg (Table 5-47). The benzo(a)anthracene EPC in SWMU 24 is 1.6 mg/kg, while the RGO for site worker exposure is 0.76 mg/kg. The RGO concentrations that exceed the EPCs are shaded in each table.

5.5.2 RGO for Groundwater Constituents

RGOs were calculated for constituents detected in groundwater for the residential exposure pathway. The equations are included in Table 44 and the RGOs are presented in Table 48. RGOs were calculated only for SWUMs 38 and 39 since none of the risks exceeded agency benchmarks at SWMU 23. As seen in Table 5-48, only benzene had an EPC concentration exceeding the RGO at a 1×10^{-5} risk level. The benzene EPC was below the 1×10^{-4} risk level.

5.5.3 RGO for Lead at SWMU 24

Lead does not have a RfD or CSF because risks from lead exposure are better evaluated by predicting the associated blood lead level in exposed receptors. The approach used here relates intake of lead from soil to blood lead concentrations in women of child-bearing age (USEPA, 1996b). Because the fetus and young children are much more susceptible to lead toxicity than adults, an RGO is developed which protects the fetus as described below.

The USEPA model assumes that the increase in blood lead from exposure to soil lead is linear. A linear biokinetic slope factor was developed for the model. It is based on available data relating fetal blood lead levels to maternal blood lead levels and soil exposure. In the guidance, USEPA (1996b) states that the basis for the RGO is the assumption that "fetuses and neonates can be adversely affected by elevated maternal blood lead concentrations, and that risk to the fetus can be estimated from the probability distribution of fetal blood lead concentrations." The baseline maternal blood lead concentrations were estimated based on the background blood lead level in the general population which ranges from about 1.7 to 2.2 μg/dL. The highest acceptable fetal blood lead level was set at be 10 μg/dL, the recommended concentration from the USEPA and the Centers for Disease Control (CDC). From the equations shown in Table 5-49, an RGO for lead of 1,400 mg/kg was calculated. The lead EPC (1,700 mg/kg) is above the calculated RGO for sludge in SWMU 24.

5.6 UNCERTAINTIES

5.6.1 Sources of Uncertainty

The risk estimates presented here are conservative estimates of the risks associated with exposure to constituents detected in soil at the site In general, conservative assumptions were made in the risk assessment process to bias the risk assessment towards protectiveness. However, uncertainty is inherent in the risk assessment process, and a discussion of these uncertainties is presented in this section. Each of the three basic building blocks for risk assessment (monitoring data, exposure scenarios, and toxicity values) contribute uncertainties.

Uncertainty always exists when using a finite set of monitoring data to represent site conditions. Because of this uncertainty, the UCL or maximum detected concentration was used to represent the EPC for each constituent in each medium. This conservative approach should bias the risk estimates to overestimate actual risks that might be associated with the site. In addition, it was assumed that the constituent concentrations remain constant throughout the relevant exposure periods. This assumption can produce uncertainties because natural attenuation processes should tend to decrease the concentrations over time. This conservative assumption is expected to generate highly protective (elevated) risk estimates.

Environmental sampling itself introduces uncertainty. This source of uncertainty can be reduced through a well-designed sampling plan, use of appropriate sampling techniques, and implementation of laboratory data validation and quality assurance/quality control (QA/QC). The data used in this report meet QA/QC requirements and are appropriate for use in a risk assessment. Although only a few samples were collected at each SWMU, the samples were collected in areas near the potential release sources and should generally reflect the highest concentrations. Again, this sampling bias should overestimate risk.

Exposure scenarios also contribute uncertainty to the risk assessment. Exposures were calculated based on the assumption that the current conditions would remain stable (i.e., no attenuation) throughout the exposure period. This assumption can produce uncertainties because natural attenuation processes should tend to reduce constituent concentrations over time. Exposure scenarios were developed based on site-specific information, USEPA exposure guidance documents, and professional judgment. Although uncertainty is inherent in the exposure assessment, the exposure assumptions also were chosen to err on the side of conservatism (i.e., to be over protective).

The toxicity values and other toxicological information (i.e., health effects) used in this report are associated with significant uncertainty. Many toxicity values are developed using results of studies in which laboratory animals are exposed to high doses. Although species differences in absorption, distribution, metabolism, excretion, and target organ sensitivity are well documented, available data are not sufficient to allow compensation for these differences. Most laboratory studies strictly control as many factors as possible, yet the human population is genetically diverse and affected by a variety of diets, occupations, pharmaceuticals, and other factors. When human epidemiological data are available, a different set of uncertainties is present. For instance, exposure dose is seldom well characterized in epidemiological studies.

Recent research on the mechanisms of carcinogenesis suggests that USEPA's use of the linearized multistage model may overestimate the cancer risks associated with exposure to low doses of chemicals (USEPA, 1996d). At higher doses, many chemicals cause large-scale cell alteration which stimulates replacement by cellular division. Dividing cells are more subject to mutations than quiescent or non-dividing cells; thus, there is an increased potential for tumor formation. It is possible that administration of these same chemicals at lower doses would not increase cell division and thus would not increase mutations. This would suggest that the current methodology may overestimate cancer risk for constituents that are not direct acting mutagens, particularly given the low doses found at the site.

Toxicity values were not available from the USEPA for all of the COCs in media at the site. The USEPA is in the process of developing inhalation toxicity values; however, these currently are not available for most constituents. Surrogate compounds were selected to represent the toxicity values for some constituents lacking values if an appropriate surrogate was available. In the absence of subchronic RfDs, chronic RfDs were used.

5.6.2 Monte Carlo Analysis

Monte Carlo Analysis is one method used to approach the uncertainty involved in the point-estimate or deterministic risk assessment. The Monte Carlo or probabilistic method of risk assessment was used in this report to calculate total cancer risks for the following site worker exposure scenarios:

(1) site worker exposure to sludge for SWMU 23;
(2) site worker exposure to surface soil for SWMU 24;
(3) site worker exposure to sludge for SWMU 24; and
(4) site worker exposure to sludge for SWMU 39.

These scenarios were selected for the Monte Carlo Analysis because the total excess lifetime cancer risks from the deterministic (i.e., point estimate) calculations exceeded the lower end (1×10^{-6}) of the range of acceptable risk values (10^{-6} to 10^{-4}). Only the cancer risks were included in the Monte Carlo Analysis since the deterministic non-cancer risks were all acceptable (i.e., HI less than 1). The following sections provide a brief description of Monte Carlo Analysis and present the exposure parameters used in the calculations.

Monte Carlo simulation is a tool which was developed by physicists over 50 years ago and has long been used by scientists and engineers in many fields. Application of Monte Carlo simulation produces a probability distribution for a modeled parameter based on the probability or uncertainty distributions for the input variables. To run a Monte Carlo simulation, an appropriate probability density function (PDF) must be defined for each selected input variable (termed the random variables) for the model. A random number generator is used to select a value for each random variable using the input PDF information. Using the selected combination of values for the random variables, a single forecast value is calculated. This process of selecting a set of random variable values and calculating the forecast value is repeated for many iterations (usually 3,000 or more). The frequency distribution for the calculated forecast values represents the probability distribution for the modeled forecast value. A total of 10,000 iterations was used in each Monte Carlo simulation for this site.

In the context of risk assessment, the forecast value of interest is the potential cancer or non-cancer risk (ELCR or HQ, respectively) related to hypothetical exposure scenarios at a particular site. The input random variables are the exposure parameters used to model the potential exposure conditions. In the derivation of an RME point-estimate of the risk (as is usually presented in a risk assessment), the input values for the exposure parameters are selected such that the point-estimate is intended to represent the 95th percentile for the risk (USEPA, 1989b). Monte Carlo simulation is a valuable tool for obtaining a risk probability distribution which can be used to better estimate the 95th percentile for risk and to determine appropriate confidence limits for the risk and indicate the uncertainty associated with the modeled risk values.

5.6.2.1 Input Random Variable Probability Distributions

This section presents the data distributions defined for each of the random variables in the Monte Carlo simulation. The relevant exposure model is the site worker exposure to soil or sludge. This exposure model considers the oral, dermal, and inhalation pathways. Table 5-50 summarizes the input PDFs for the selected random variables. The following paragraphs discuss the source of each input PDF.

<u>Averaging Period and Exposure Period</u>

In the Monte Carlo calculation of cancer risk (ELCR), the averaging period (AP) was not treated as a random variable; the value was held constant at 70 years. The AP for cancer effects was not considered a random variable since the derivation of the CSFs is based upon a 70-year lifetime. Although the AP is constant, the exposure period (EP) will vary and was defined as a random variable for the Monte Carlo Analysis.

Percentile data for the site worker exposure period PDF were obtained from the literature (Finley et al., 1994; American Industrial Health Council [AIHC], 1994):

Minimum = 0 Maximum = 30 years

25th percentile of 1 year

50th percentile of 3.8 years

75th percentile of 11 years

90th percentile of 19 years

95th percentile of 25 years

These percentile data are based on Bureau of Labor Statistics information on the working tenure for U.S. workers. The mean of the values used for the exposure period in the Monte Carlo simulations was reported as approximately 7 years.

Body Weight

The adult body weight (BW) PDF represents adult male data presented in the USEPA *Exposure Factors Handbook* (USEPA, 1997b) into a cumulative distribution with the following parameters:

Minimum = 51 kg Maximum = 107 kg (AIHC, 1994)

5th percentile of 58.6 kg

10th percentile of 62.3 kg

15th percentile of 64.9 kg

25th percentile of 68.7 kg

50th percentile of 76.9 kg

75th percentile of 85.6 kg

85th percentile of 91.3 kg

90th percentile of 95.7 kg

95th percentile of 102.7 kg

The BW and exposed skin surface area (SSA) variables were correlated with one another using a correlation coefficient of 0.85 (selected based on professional judgment).

This large positive correlation coefficient is intended to account for the fact that individuals with high BW values are expected to also have high SSA values, while low SSA is expected to correspond with low BW.

Exposure Frequency

The exposure frequency (EF) for the site worker was based on the PDF cited for residential exposure (triangular distribution with a minimum of 180 days/year, a most likely value of 345 days/year, and a maximum value of 365 days) (Smith, 1994). This residential PDF was multiplied by a factor of 5/7 (based on 5 workdays per 7-day week) and reducing the maximum value by 5 to account for 5 holidays per year, resulting in a triangular distribution with minimum of 130 days/year, most likely value of 240 days/year, and maximum of 255 days/year.

Exposure Point Concentration

The constituent EPCs were defined based on the analytical data presented in Section 5.1.1. For all but one scenario, no PDFs were defined for the EPCs; rather, the software was set to randomly select one of the actual measured or modeled concentration values with each iteration of the Monte Carlo simulation (a process referred to as bootstrapping). The selection probability for each measured or modeled concentration value was determined by the frequency with which that value appears in the dataset. For the site worker exposure to surface soil (the scenario with the highest total ELCR), the data for benzo(a)pyrene, benzo(a)anthracene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were fit to a log-normal distribution using the Crystal Ball[R] software. These constituents were selected because they each had ELCRs exceeding 1 x 10^{-6}, and it was intended that the log-normal distribution would give a more complete representation of the data.

Exposure Time

Based on professional judgment, the daily exposure time PDF for the site worker was input as a triangular distribution, ranging from 0 to 9 hours/day, with 8 hours/day as the most likely value.

Skin Surface Area

The SSA PDF for the Monte Carlo simulation was derived based upon data presented in the USEPA *Exposure Factors Handbook* (USEPA, 1997b; Kissel et al., 1996) which presents the SSA percentile data for men and women and recommends that for outdoor exposures in areas of moderate temperature, the assumption that 5 percent of the total body SSA is exposed during winter months, 10 percent in the spring and fall, and 25 percent in the summer months. This is a conservative assumption since workers are unlikely to wear shorts, which is assumed in the 25 percent value for the summer months. Assuming 3 months per season, this results in an SSA PDF which is 0.125 multiplied by the PDF for total body SSA (Normal, with Mean = 19,700 square centimeters [cm^2], standard deviation = 1,900 cm^2). Thus, the input PDF for SSA was NORMAL, with a mean of 2,460 cm^2 and a standard deviation of 240 cm^2. As stated previously, the BW and SSA variables were correlated with one another using a correlation coefficient of 0.6 (based on professional judgment).

Soil Adherence Rate

The PDF for soil adherence rate (SAR) was derived based on data from Kissel et al. (1996), as presented by USEPA (1997b). Kissel measured soil loading on the skin of the hands, arms, face, and feet of people engaged in a variety of activities. For this site, data for 5 groups of groundskeepers (a total of 29 individuals) were used to conservatively represent site worker activity. It was assumed that the hands, forearms, and head would be exposed, and the SAR data reported by Kissel et al. (1996) were area-averaged using the relative areas of the three body parts and the SAR values reported for each. Using this input in a Monte Carlo Analysis resulted in a PDF which was approximately normal with a mean of 0.03 milligrams per square centimeter (mg/cm^2) and a standard deviation of 0.003 mg/ cm^2.

Soil Ingestion Rate

The site worker soil ingestion rate was derived from data for adult soil ingestion. Based on the default soil ingestion rate point estimate value of 100 mg/day for adults vs. the default point estimate value of 50 mg/day for a site worker (USEPA, 1991), the cumulative probability data reported in the *Exposure Factors Sourcebook* (AIHC, 1994) was reduced by a factor of 1/2:

Minimum = 0 Maximum = 108 mg/day
67 percent probability less than or equal to 8.5 mg/day
83 percent probability less than or equal to 74 mg/day

5.6.2.2 Monte Carlo Results

A Monte Carlo simulation of total ELCR was run using the input random variable PDFs described in the previous section and presented in Table 5-50. The forecast probability density curves for total ELCR are shown in Table 5-51. The median (50th percentile), mean, and 95th percentile for the ELCR forecast probability density curves are presented below:

Total ELCR
(Monte Carlo Results)

Exposure Medium	Median	Mean	95th %
SWMU 23 Sludge	3E-08	2E-07	9E-07
SWMU 24 Sludge	4E-08	2E-07	1E-06
SWMU 24 Surface Soil	8E-08	5E-07	2E-06
SWMU 39 Sludge	1E-08	9E-08	4E-07

The 95th percentile values all lie below or slightly exceed the lower end of the range of acceptable cancer risk (10^{-6} to 10^{-4}); the median and mean values all lie below this level. Typically, the median value is used to represent average exposure conditions while the 95th percentile is used to represent RME conditions. Based on these results, the site does not pose unacceptable cancer risk under the assumed exposure conditions.

5.7 ECOLOGICAL RISK ASSESSMENT

The objective of the ecological risk assessment (ERA) is to determine whether constituents detected at SWMU 23, SWMU 24, and SWMUs 38 and 39 have the potential to adversely affect the ecosystem at these SWMUs or surrounding areas. The standard paradigm for predictive ERA, as presented in the USEPA Framework for Ecological Risk Assessment (USEPA, 1992), the USEPA Region 4 Supplemental Guidance to the Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1996a), and the Ecological Risk Assessment Guidance for Superfund (USEPA, 1997c), was adapted to the ecological assessment of the site.

The first step of the ERA is problem formation which discusses site characteristics, selection of constituents of ecological concern (COECs), endpoints and measurements for the assessment, and potential receptor populations. The second step is the exposure assessment that evaluates the relationship between ecological receptors and affected media at the site. The third step of the ERA is the effects assessment that discusses available toxicity data for COECs. The fourth step of the ERA is the risk characterization that integrates the results of the exposure assessment and effects assessment to estimate risks to potential ecological receptors

5.7.1 Problem Formation

This section describes the relative ecological attributes of SWMUs 23, 24, 38, and 39, the selection of COECs, and the endpoints for the assessment. Potential sources of contamination are discussed in Section 5.3.2 (Conceptual Site Exposure Model).

5.7.1.1 Environmental Description

An ecological inventory (EI) was conducted at the site June 2 through June 4, 1997, to characterize the biotic resources associated with SWMUs 23, 24, 38, and 39 as part of the ongoing RFI. The objectives of the EI were to: (1) gather qualitative and semi-quantitative information on the ecological communities present at the site; (2) identify pathways by which biological receptors could be exposed to media containing site-related constituents; and (3) document any visible evidence of stress on biological receptors at the site. The findings of the EI are summarized below.

During the investigation, a survey of the terrestrial flora and fauna of the site was conducted. A limited survey of aquatic flora and fauna was conducted. No attempt was made to assemble a complete list of plant and animal life within the site; however, a representative list was compiled utilizing as many different plant and animal types and species as possible via sight and sound surveys. Survey evidence included plant and animal sightings, animal calls, bird songs and calls, and animal droppings and tracks. Terrestrial and aquatic ecosystems and associated plant and animal species were visually observed for any signs of stress placed upon them by the site and/or human activities (i.e., land development), and/or by abnormal natural events such as drought or flooding.

To characterize biotic resources, each area was investigated. Identification of major vegetative communities and the species composition were recorded by written field notes. Photographs were taken to document field observations/conditions. Potential wetland areas were identified based on observed vegetation, soil, and hydrologic characteristics. All communities were characterized for their potential to support biota and observations of biotic communities and/or species which appeared stressed or unhealthy.

Plant species follow nomenclature found in Radford et al. (1968) and Petrides (1988), and animal species follow documentation in Mount (1975), Rhode et al. (1994), Stokes (1996), and Webster et al. (1985). Scientific nomenclature and common names (when applicable) are provided for each plant and animal species listed. Subsequent references to the same organism include the common name only. The presence of wetland habitats on site was determined using Cowardin et al. (1979), Environmental Laboratory (1987), and Wetland Training Institute, Inc. (1991).

During surveys, wildlife identification involved a variety of observation techniques: active searching and capture, visual observations (both with and without the use of binoculars), and identifying characteristic signs of wildlife (sounds, scats, tracks, burrows, etc.). Organisms captured during these searches were identified and released without injury. Equipment used for aquatic sampling included a hand-held dip net and minnow traps.

A variety of plant and animal species occur on the site and in the surrounding areas. SWMUs 23, 38, and 39 contain habitats potentially used by ecological receptors.

SWMU 24 consisted primarily of barren soil and is of an industrial nature such that limited useable habitat is present. Potentially complete exposure pathways for terrestrial animals include exposure to potentially impacted soils and/or sludges. Exposure routes may include direct contact and ingestion; volatilization is considered to be a minor exposure route. Based on qualitative observations, no adverse ecological effects were apparent at the site. The nearest surface-water body to the site is Five Mile Creek. Much of the storm-water runoff from the site drains to a large surface impoundment (polishing pond) before permitted discharge to Five Mile Creek. Therefore, limited potential exists for constituent migration pathways to aquatic receptors in the creek. No evidence was found during the site visit of stressed biota resulting from off-site migration. Specific information concerning the EI is summarized below.

5.7.1.1.1 Physical Resources

Jefferson County is in the Appalachian Highlands major physical division of the United States. Birmingham is in the southeastern part of the county and lies in the Tennessee section of the Valley and Ridge physiographic province. This province is underlain by sedimentary bedrock deformed by folding and faulting. Horizontal compression of the bedrock produced a series of major folds, called anticlines and synclines. These folds were broken by major shear fractures, called thrust faults, causing portions of the folds to be displaced northwestward for several miles. During this period, approximately 200 million years ago, a series of long, narrow parallel valleys and ridges developed. The ridges have bedrock that are more resistant to erosion than material in the valleys. These valleys and ridges are oriented in a northeast-southwest direction (Spivey, 1982).

5.7.1.1.1.1 Soil

The process of soil development depends upon both biotic and abiotic influences. These influences include past geologic activities, nature of parent material, environmental and human influences, plant and animal activity, age of sediments, climate, and topographical position.

SWMUs 24, 38, and 39 are underlain by Urban Land, while SWMU 23 is underlain by the Allen-Urban land complex. Urban Land soils consist of areas covered by commercial, industrial, and high density residential facilities. These areas have been altered to achieve large areas that are nearly level, to avoid flooding or wetness problems, or to increase the load supporting capacity. The original soils were altered by cutting and filling, shaping and grading, excavating, blasting, compacting, or covering with concrete or asphalt. The Allen-Urban land complex consists of strongly sloping, well drained Allen soils and areas of Urban Land on mountain foot slopes and uplands of limestone valleys. The available water capacity of Allen soils is moderate to high. Permeability is moderate, and the shrink-swell potential is low. Surface runoff is moderately fast (Spivey, 1982).

5.7.1.1.1.2 Water Resources

Several unnamed tributaries are responsible for carrying the surface drainage off of the Sloss property. Two drainages, one west of SWMU 38 and one east of SWMU 39, carry surface runoff from these SWMUs into Five Mile Creek, located north of the property. The drainage west of SWMU 38, the Stormwater Runoff Sewer (SWMU 25), was established to carry stormwater runoff from the Sloss Facility and noncontact cooling water into a polishing pond before entering Five Mile Creek. The other drainage, adjacent to SWMU 39, flows into Five Mile Creek. SWMU 23 is primarily a ponded area. A pipe located along the southern dike drains this area. Surface runoff travels southward down the hill and eventually flows into the polishing pond. Surface runoff from SWMU 24 also flows into the polishing pond. A drain along the northern perimeter of the polishing pond diverts water directly into Five Mile Creek.

5.7.1.1.2 Biotic Communities

This section describes the existing vegetation and associated wildlife that occur within the vicinity of SWMUs 23, 24, 38, and 39. Wildlife and other fauna are observed less easily than the flora of an area without special efforts by the investigators. The wildlife associated with the study area of the proposed project are divided into two sections: terrestrial fauna and aquatic life. Some taxa will often occupy both terrestrial and aquatic habitats. Descriptions of fauna likely to occur within the project area, based on the evidence available, are given below.

5.7.1.1.2.1 SWMU 23

SWMU 23, known as the BTF Sludge Disposal Area, is located at the northwest part of the Sloss facility. The unit received approximately 10 tons of biological sludge a day until 1993 when all disposal in the unit was discontinued. Currently, terrestrial plant communities within SWMU 23 are represented by two major community types: successional and wetland. SWMU 23 appears as a very shallow pond bounded by a soil dike along its entire southern perimeter. A dense mat of vegetation covers the majority of the SWMU, which is approximately 2 acres in size.

Successional plant communities present along the rim and adjacent upland areas of SWMU 23 include several species of ragweed (*Ambrosia* spp.), goldenrod (*Solidago* sp.), pokeweed (*Phytolacca americana*), aster (*Aster* spp.), milkweed (*Asclepias* spp.), smooth sumac (*Rhus glabra*), dogfennel (*Eupatorium* sp.), mulberry (*Morus* sp.), black cherry (*Prunus serotina*), broomstraw (*Andropogon* sp.), morning-glory (*Ipomoea* sp.), birch (*Betula* sp.), Queen Anne's lace (*Daucus carota*), and blackberry (*Rubus* sp.).

Wetland plant communities consist primarily of emergent vegetation. Dominant vegetation includes soft rush (*Juncus* sp.), cattail (*Typha latifolia*), and duckweed (*Lemna* sp.). Young willow (*Salix* sp.) also was observed around the edges of the pond.

Wildlife species observed utilizing areas of SWMU 23 were primarily birds. Barn swallows (*Hirundo rustica*), purple martins (*Progne subis*), red-winged blackbird (*Agelaius phoeniceus*), killdeer (*Charadrius vociferus*) and mourning dove (*Zenaida macroura*), were observed in the area. Amphibians, such as the gray treefrog (*Hyla versicolor*) and leopard frog (*Rana sphenocephala*), were heard calling. One mammal, an eastern cottontail rabbit (*Sylvilagus floridanus*), was observed near the SWMU. No reptiles were observed. Other animals are expected to utilize this community either for foraging or shelter. Common animals expected to occur include those adapted to disturbed and early successional areas. Species of mice, rats, snakes, lizards, frogs, toads, and small mammals may be observed in the vicinity of the SWMU. Overall, wildlife diversity in the vicinity of the SWMU is expected to be moderate as a result of the surrounding undeveloped land.

A low diversity of aquatic species is expected. Frogs appear to be the dominant faunal type. No minnows or other fish were observed or noted during the field investigation. The water was discolored and a sheen was visible. The water also had an odor.

5.7.1.1.2.2 SWMU 24

SWMU 24 is near the northeast corner of the property, immediately south of the polishing pond. SWMU 24 is a blast furnace emission control sludge waste pile and contains black granular material generated during the production of pig iron from 1958 to 1979. Field observations indicate that much of the sludge material associated with the SWMU has been removed. Sludge material is currently being removed from the area.

The majority of the SWMU is barren land. A large amount of sludge appears to have been removed from the northernmost area. Vegetation is in a very early stage of succession. The northern area of the SWMU exhibits mainly pioneer species such as goldenrod, ragweed, blackberry, and various grasses. The diversity at the present time is relatively low. SWMU 24 is approximately 10 acres in size.

Wildlife diversity in the area is consistent with plant diversity. Very few species were noted during the field investigation. The species observed were red-winged blackbird, killdeer, and bank swallows, and were noted along the northernmost portion of the SWMU, adjacent to the polishing pond. No aquatic habitats are present at SWMU 24.

5.7.1.1.2.3 SWMU 38

SWMU 38 is in the north-central part of the Sloss facility, west of the quarry and south of SWMUs 23 and 24. It consists of a landfill used by Sloss for construction-type debris. Other debris identified at the landfill included concrete rubble, conveyor belts, wood, construction material, empty 55-gallon drums, flue dust, and coal. This SWMU has more diversity of vegetation and wildlife than SWMUs 23 and 24. SWMU 38 is bounded to the west by a stormwater runoff sewer (SWMU 25) and to the east by an above-ground BTF sewer line. SWMU 38, used for disposal of construction debris and soil from excavation activities, is approximately 10 acres in size.

The vegetation present in and around SWMU 38 is classified as disturbed. Areas along the slopes of the SWMU exhibit a canopy and understory of vegetation while areas on the top only have pioneer species. The rim of the SWMU is relatively flat and void of vegetation. Hackberry (*Celtis laevigata*), box elder (*Acer negundo*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), water oak (*Quercus nigra*), red cedar (*Juniperus virginiana*), black walnut (*Juglans nigra*), birch (*Betula* sp.), mullein (*Verbascum* sp.), and princess-tree (*Paulowinia tomentosa*) were noted along these slopes. Vines included grape (*Vitis* sp.), Virginia creeper (*Parthenocissus quinquefolia*), Japanese honeysuckle (*Lonicera japonica*), trumpet creeper (*Campsis radicans*), and poison ivy (*Toxicodendron radicans*). Herbaceous vegetation noted on the slopes of the SWMU consisted of goldenrod, ragweed, milkweed , mimosa (*Albizia julibrissin*), clover (*Trifolium* sp.), aster, Queen Anne's lace, pokeweed, thistle (*Carduus* sp.), and spleenwort (*Asplenium* sp.). In addition to mimosa, birch, box elder, and Japanese honeysuckle, cocklebur (*Xanthium* sp.), morning glory (*Ipomoea* sp.), vetch (*Vicia* sp.), and blackberry (*Rubus* sp.) were noted along the top portions of SWMU 38.

A small wetland community was noted outside the northern perimeter of SWMU 38. It consists primarily of bottomland hardwoods (maples, oaks, etc.) and is approximately 1 acre in size. This community resulted from an influx of water from the USEPA drainage canal. A blockage was noted in the canal which caused the diversion of water into this area. The water was retained in this area by a small rock outcrop outside of the northeast perimeter.

Bird species observed in the landfill area were northern bobwhite (*Colinus virginianus*), mockingbird (*Mimus polyglottos*), red-winged blackbird, mourning dove, killdeer, and bank swallows. One eastern cottontail rabbit was noted along the northern perimeter. Otherwise, no reptiles or amphibians were seen; however, habitat is available for these and other species that require open, disturbed areas. A low diversity of wildlife is expected to utilize this community due to its location and proximity to surrounding forested communities.

A minnow trap was set just below the rock outcrop in the area inundated by the USEPA drainage canal. One banded pigmy sunfish (*Elassoma zonatum*) was captured. No other aquatic fauna was observed in this area.

5.7.1.1.2.4 SWMU 39

SWMU 39 is also a blast furnace waste pile. SWMU 39 contains black granular material, similar to SWMU 24, that was generated during the production of pig iron from 1958 to 1979. The waste pile at SWMU 39 is a northeast-southwest trending ridge that is adjacent to SWMU 38. SWMU 39 is approximately 10 acres in size.

Vegetation associated with SWMU 39 is very similar to that of SWMU 38 except that pines, including loblolly pine (*Pinus taeda*) and Virginia pine (*Pinus virginiana*), occupy the northern perimeter rather than hardwoods.

One wetland community is along the eastern boundary of SWMU 39. This community is associated with the drainage canal that flows into Five Mile Creek. Cattails, soft rush, willow, and water oak were the dominant vegetation. The wetland community opens into a small pond-like area immediately north of the SWMU.

Wildlife observed in the vicinity of SWMU 39 consists mostly of birds: mockingbird, gray catbird (*Dumetella carolinensis*), red-winged blackbird, northern cardinal (*Cardinalis cardinalis*), great crested flycatcher (*Myiarchus crinitus*), mourning dove, and bank swallows. Like SWMU 38, SWMU 39 is expected to have a low diversity of wildlife primarily due to its location.

Aquatic fauna were observed in the adjacent drainage canal and small pond area. Eastern mosquito fish (*Gambusia* affinis), crayfish (*Procambarus* sp.), dragonfly nymphs, and several frogs (*Rana* sp.) were observed in these areas. The diversity of aquatic fauna is also expected to be low due to its location and surrounding land uses.

5.7.1.1.3 Biotic Stresses

Indications of potential biotic stress were looked for during the field investigation. Biotic stress may be induced by chemical and/or non-chemical anthropogenic activities. Chemically-induced stress may be identified by a number of characteristics including reduced biotic diversity, changes in community composition, and mortality of organisms. Stained soil, surface-water odors, or other signs of potential impacts may also indicate chemically-induced stress. Non-chemical anthropogenic effects such as urban development and agricultural practices may also result in reduced biotic diversity and/or abundance, changes in community composition, and organisms mortality.

Vegetation at the site was found to be in good condition. No difference in vegetation health was observed between plants on-site and off-site. The vegetation present at the SWMUs appeared healthy.

5.7.1.1.4 Special Status Species

The Alabama Natural Heritage Program and the Alabama Division of Game and Fish were requested to provide the most recent information concerning the occurrence of threatened and/or endangered plant and animal species, any habitats of special concern, and/or environmentally sensitive areas at or in the vicinity of the site. The requests and responses are presented in Appendix E. Responses from these agencies indicated that a Federally endangered fish species, the Watercress Darter (*Etheostoma nuchale*), inhabits Roebuck Springs, which is approximately 3 to 5 miles east of the site. Due to the fact that the Watercress Darter is found only in watercress-choked waters of limestone origin with substrate of angular gravel in riffle areas and silt and mud in areas of watercress and these types of surface-water bodies do not exist on or near the site, there is no reason to believe that COECs present any potential impact to this animal species. Additionally, COECs identified at the site would not be expected to migrate to Roebuck Springs.

5.7.1.2 Selection of Constituents of Ecological Concern

The selection of potential COECs for the ERA involves a screening process that is used to limit the constituents that require evaluation in the assessment to those constituents of greatest ecological concern. Because the toxicity of some constituents to wildlife differs from that of human receptors, the COECs for the ERA may differ from those evaluated in the human health risk assessment. Data used in the determination of potential COECs are presented in Tables 5-1 through 5-6.

COECs were selected by comparing maximum constituent concentrations detected in soil and sludge samples to background constituent concentrations and Oak Ridge National Laboratory (ORNL) preliminary soil remediation goals (PRGs) for ecological endpoints (ORNL, 1996). Background data for soil were presented in Table 5-9. ORNL Ecological PRGs for soil were selected by comparing toxicological benchmarks for plants, microorganisms, earthworms, and wildlife, and selecting the lowest value as the PRG. Constituent concentrations detected in soil and sludge samples at each SWMU that exceeded two times the site-specific background concentration or the ORNL PRG were retained as COECs. The selection of COECs is presented in Table 5-52 for the subsurface soils and Table 5-53 for the sludge at SWMU 23. Tables 5-54 and 5-55 present the COEC selection results for the subsurface soil at SWMUs 38 and 39 and sludge at SWMU 39.

5.7.1.3 Assessment and Measurement Endpoints

This ERA focuses on representative receptors that may be affected directly or indirectly by selected COECs and the likelihood and extent of those effects. Flora and fauna observed at the site were discussed in Section 5.7.1.1. Terrestrial receptors were selected for quantitative exposure assessment to surface soil and sludge. Potential risks to aquatic receptors were not assessed in this risk assessment since the major bodies of water associated with the site (various drainage ditches and Five Mile Creek) will be sampled and assessed at a later date as part of subsequent field activities and reports.

The endpoint for this assessment was effects on herbivorous populations through soil and sludge exposure sufficient to impair reproduction. COEC concentrations in soil, sludge, and food sources were compared to toxicological benchmark values as a measure of this endpoint. Toxicological benchmark values are presented in Table 5-56.

It is not feasible to evaluate COEC effects on all species using habitats at the site; therefore, target receptor species are selected and evaluated as surrogate species for terrestrial organisms with the greatest potential for exposure. The eastern cottontail rabbit (*Sylvilagus floridanus*) was selected as an indicator species to evaluate the assessment endpoints because it is societal, has a range small enough to be associated with the site, serves as prey for a variety of species, would be expected to be exposed to media at the site, and was observed on-site during the ecological field survey.

5.7.2 Exposure Assessment

The exposure assessment evaluates the relationship between ecological receptors and media at the site. Potential exposure pathways, exposure point concentrations, specific target receptor species, and exposure doses are discussed in this section.

5.7.2.1 Exposure Pathways

The primary means by which ecological receptors may be exposed to constituents at the site is through incidental ingestion of, and dermal contact with, surface soil and/or sludge. Potential exposure pathways for terrestrial wildlife include ingestion of food (either plant or animal), incidental ingestion of soil while foraging, grooming or burrowing, inhalation of particulates or vapors potentially released at the site, and ingestion of surface water. The total exposure by terrestrial wildlife is represented by the sum of the exposures from each individual source. COECs at the site (primarily SVOCs and inorganics/metals) are not expected to volatilze and as previously indicated, surface water is not evaluated in this assessment with the exception of mercury; COECs identified at the site would not be expected to bioaccumulate in organisms. Therefore, the exposure pathways evaluated for the cottontail rabbit included direct exposure to COECs via soil and sludge ingestion and indirect exposure to COECs via ingestion of vegetation at the site.

5.7.2.2 Exposure Point Concentrations

Wildlife species are mobile and likely use various portions of the site. They are unlikely to be exposed to maximum detected constituent concentrations. Therefore, estimates of exposure to COECs by wildlife species were calculated using the upper 95 percent UCL on the arithmetic average constituent concentrations detected in soil and surface-water media at the site.

5.7.2.3 Exposure Dose Calculation

Potential exposure pathways for the cottontail rabbit at the site include ingestion of food (plants), incidental ingestion of surface soil, ingestion of drinking water, and inhalation of contaminated air or particles. Respiration data were unavailable for the rabbit and as previously mentioned, COECs at the SWMUs are not expected to volatilize; therefore, the inhalation pathway was not evaluated. Surface-water data are unavailable to evaluate the drinking-water pathway. The daily intake of COECs for the rabbit through ingestion of food (plants) and soil was estimated by the following equation:

$$\frac{I=[(Cveg)(Iv)+(Cs)(Is)](H)}{BW} \qquad \text{(USEPA, 1997c)}$$

where:

I = total estimated constituent intake (mg/kg/day);

Cveg	=	constituent concentration in vegetation (mg/kg);
Cs	=	constituent concentration in soil or sediment (mg/kg);
Iv	=	ingestion rate of vegetation (kg/day);
Cs	=	constituent concentration in soil or sludge (mg/kg);
Is	=	ingestion rate of soil or sludge (kg/day);
H	=	home range/area of concern (unitless); and
BW	=	body weight (kg).

Information required to estimate constituent exposure for the target species was obtained from the available literature. The food consumption rate for the rabbit is reported to be 0.237 kg/day (Dalke and Sime, 1941), and the incidental soil ingestion rate is assumed to be 6.3 percent of the diet or approximately 0.15 kg/day (Sample and Suter, 1994). The average cottontail body weight is 1.2 kg (Sample and Suter, 1994), and the home range ranges from 7.65 acres to 19.26 acres (Sample and Suter, 1994). The area of the SWMUs ranges from approximately 2 acres (SWMU 23) to 10 acres (SWMUs 38 and 39). An area use factor of 1, which equals the home range divided by the area of each SWMU, was used as a conservative measure.

Data on the constituent concentrations in vegetation (Cveg) were not available. Therefore, these values were estimated using soil to plant uptake factors obtained from the literature. Soil-to-plant uptake factors (PU) for organic constituents were derived using methods presented by Travis and Arms (1988) in which uptake factors for organic constituents in vegetation is inversely proportional to the square root of the octanol-water partitioning coefficient (K_{ow}). PUs for inorganic constituents were obtained from Baes et al. (1984). The PUs are presented in Table 5-57. PUs estimate constituent concentrations on a dry-weight basis. Therefore, a dry-to-wet conversion must be used. Based on the assumption that fresh foliage is 85 percent water (USEPA, 1993), the COEC in fresh vegetation is estimated by the following equation:

$$Foliage_{fresh} = Foliage_{dry} \times (1\text{-}W)$$

where:

$Foliage_{fresh}$	=	constituent concentration in fresh foliage;
$Foliage_{dry}$	=	constituent concentration in dry foliage; and
W	=	proportion of water in foliage (0.85).

Therefore, Cveg is calculated by multiplying the COEC concentration in soil by the PU and by 1-W.

5.7.3 Effects Assessment

Information on the measurement endpoints and potential toxicity of COECs to ecological receptors is presented and discussed in this section. Measurement endpoints are used to link conditions at the base with the assessment endpoints (Section 5.7.1.3, Assessment and Measurement Endpoints). The measurement endpoint included:

- A hazard quotient in excess of 1 for COECs for the selected terrestrial herbivore indicator species (cottontail rabbit), white-footed mouse, and white-tailed deer;

Toxicity information derived from the literature was used to develop benchmark values for the selected indicator species. By comparing constituent concentrations measured at the site to these benchmarks, the likelihood that constituents pose a risk to ecological receptors was determined. Calculated exposure doses and constituent concentrations were compared to benchmarks to derive HQs used in the assessment. To determine potential hazards to the indicator species, benchmarks related to reproductive endpoints were used whenever possible. Reproductive endpoints generally are considered protective at the population level, against sublethal adverse effects associated with chronic exposure to a particular constituent. However, based on a comprehensive review of the scientific literature, measurement endpoints related to reproductive effects were not available for some COECs.

Toxicity benchmarks for evaluation of effects to the indicator species were selected from the following sources, listed in order of preference:

(1) chronic NOAELs presented in Sample et al. (1996);
(2) chronic NOAELs presented in the primary literature (various authors); and
(3) toxicological information presented in the primary literature (various authors).

The chronic NOAELs presented are based on experimental studies on laboratory animals. When necessary, uncertainty factors of 10 were used when extrapolating from acute or subchronic studies to chronic effects and when extrapolating from LOAELs to NOAELs (Sample et al., 1996).

The chronic NOAELs for the test species were adjusted further using a scaling factor to account for differences in body weights between the test species and the indicator species. Larger animals have lower metabolic rates and therefore have lower rates of detoxification than smaller animals (Sample et al., 1996). The following equation from Sample et al. (1996) was used to account for body weight differences for each COEC:

$$\text{chronic NOAEL}_i = \text{chronic NOAEL}_t \times (BW_t/BW_i)^{1/4}$$

where:

chronic $NOAEL_i$	=	chronic NOAEL for indicator species;
chronic $NOAEL_t$	=	chronic NOAEL for test species;
BW_i	=	body weight of indicator species; and
BW_t	=	body weight of test species.

The body weights of the test species and the indicator species were taken from the available literature. Toxicological benchmarks for the rabbit are presented in Table 5-56.

5.7.4 Risk Characterization

Risk characterization integrates the results of the exposure assessment and effects assessment to estimate risk to potential ecological receptors. Information from the biological field survey was used in conjunction with site-specific soil and sludge data to qualitatively and quantitatively evaluate the potential risks and to provide a weight-of-evidence approach to best estimate risks at the site. The principal lines of evidence concerning effects used in this assessment were biological data collected during the field survey, which address the actual condition of the receiving environment, and calculation of the effects of exposure on endpoint species using the quotient method.

Potential risks to ecological receptors were assessed by comparing media-specific COEC concentrations or estimated daily doses with toxicological benchmarks. This comparison, called the HQ method, compares estimated expected environmental concentrations (EEC) for a specific constituent or daily doses to benchmark values to determine whether the EEC or receptor dose is less than or equal to an acceptable or "safe" dose. The HQ is defined as the ratio of the EEC or the estimated daily dose of a constituent through a particular exposure route to the benchmark for the same constituent through that ingestion route. This process is similar to the calculation of the HQ for human health. The comparison was made for each COEC and is expressed as:

$$HQ = \text{Dose (mg/kg-day)}/\text{benchmark (mg/kg-day)}$$

where:

HQ	=	hazard quotient;
Dose	=	estimated constituent dose for a given receptor; and

benchmark = toxicological benchmark value.

Using this method, the degree to which a particular constituent concentration exceeds a toxicological benchmark can be evaluated. Therefore, an HQ greater than 1 indicates that a given exposure dose exceeds the toxicological benchmark for a particular species. The greater the HQ, the greater the exceedence. An HQ less than 1 indicates that, for a particular constituent-species interaction, ecological risks are unlikely to occur.

Exposures to the same constituent that may occur through multiple exposure pathways was considered using the quotient method for soils. An HQ for a specific chemical (HQchem) represents the sum of the individual HQs for a constituent through more than one pathway. For example, the cumulative HQ for an individual constituent was determined for the white-footed mouse by summing the HQs for plant ingestion and soil ingestion, or:

$$HQ_{chem} = HQ_{plant} + HQ_{soil}$$

where:

HQ_{chem} = hazard quotient for an individual constituent;

HQ_{plant} = hazard quotient for the constituent through plant ingestion; and

HQ_{soil} = hazard quotient for the constituent through soil ingestion or sludge.

The quotient method can also be used to estimate impacts to receptors potentially occurring from exposure to multiple constituents through all exposure pathways at the site. A cumulative HI (HI_{cum}), representing the sum of individual HQ_{chem} or individual HQs for each COEC, was calculated for the indicator species at the site. This calculation is based on the assumption that the potential toxicity of multiple constituents is additive.

A discussion of potential risks posed to terrestrial wildlife by constituent concentrations detected at the site is provided in the following paragraphs.

Potential risks to herbivorous terrestrial wildlife through exposure to soil and sludge were assessed by comparing estimated daily doses of COECs (based on the lesser of the 95 percent UCL and the maximum detected concentration) with toxicological benchmark values using the white-footed mouse and the white-tailed deer as endpoint species. The rabbit was assumed to be exposed to COECs through the ingestion of COECs in vegetation and the incidental ingestion of COECs in soil and sludge. HQs for the rabbit based on exposure to soil, vegetation, and sludge for each SWMU with useable habitat (e.g., SWMU 23 and SWMUs 38 and 39) are presented in Tables 5- 58 through 5-61 and are summarized below.

The HI for herbivorous terrestrial wildlife exposure to soil and vegetation at SWMU 23 was 6 (Table 5-58). With the exception of arsenic, no COEC concentration detected in soil produced an HQ greater than 1. The HI for herbivore exposure to sludge and vegetation at SWMU 23 was 950 (Table 5-59). Constituents producing HQs greater than 1 included benzo(a)pyrene, arsenic, barium, mercury, and selenium.

The HI for herbivorous terrestrial wildlife exposure to soil and vegetation at SWMUs 38 and 39 was 3 (Table 5-60). Antimony and barium were the only constituents that produced HQs greater than 1. The HI for herbivore exposure to sludge and vegetation at SWMUs 38 and 39 was 27 (Table 5-61). Constituents producing HQs greater than 1 included antimony, barium, cadmium, lead, and zinc.

Given the likelihood that the rabbit consumes food not found at the SWMUs and, therefore, ingests less soil and vegetation from the SWMUs than estimated, the true dose is likely to be much lower than that calculated. Additionally, the conservative nature of the literature-derived toxicity values used to evaluate ecological risks likely overestimates potential risks to receptors. For example, when the background arsenic concentration (11 mg/kg) is used in the exposure equation, an HQ (of 3) in excess of the benchmark value of 1 still results.

Based on the conservative assumptions and toxicity data used in this assessment, the minimal exceedence of the benchmark HI of 1 for exposure to soil, and the diverse and healthy assemblage of vegetation and wildlife observed during the field survey, unacceptable risks would not be expected for wildlife exposure to soil at SWMU 23 and SWMUs 38 and 39. Although the conservative nature of the assessment likely overestimates risks associated with wildlife exposure to sludge at SWMU 23 and SWMUs 38 and 39, the exceedences of the benchmark HI of 1 indicate that there is the potential for unacceptable risks associated with wildlife exposure at these SWMUs.

5.7.5 Ecological Risk Assessment Uncertainties

Major sources of uncertainty in the ecological assessment are the selection of the indicator species, the use of the site by this species, and the dose estimation. Differences in the feeding habits, habitat, behavior, and activity patterns of animals can result in varying exposure to COECs. The rabbit was assumed to be appropriate indicator species, but may not represent the most sensitive species. The selection of this species was based on the biological survey conducted at the site. Estimation of the COEC dose involves several uncertainties including the COEC concentration estimated to be taken up from media, the assumed diet of rabbits potentially using the site and their daily food and soil ingestion rates, and utilization of the site. The exposure assumptions used are conservative and would overestimate the actual risk to this species.

5.8 CONCLUSIONS

The human health risk assessment evaluated potential human health effects based on exposure to constituents in soil, sludge, and groundwater at SWMU 23, SWMU 24, and SWMUs 38 and 39. The potential exposure scenarios evaluated were contact to surface soil, sludge, and groundwater by a Sloss site worker and contact to subsurface soil by a hypothetical future construction worker and contact with surface soil by a potential trespasser. Site worker exposure was calculated for exposure to sludge for SWMUs 23, 24, and 39, and was calculated for exposure to surface soil for SWMU 24. Construction worker exposure was calculated for exposure to subsurface soil and groundwater in SWMU 23 and SWMUs 38 and 39. Surface soil and sludge data were used to evaluate current exposure conditions for site workers, and subsurface soil data were used to evaluate future conditions for construction workers. The results of the deterministic (point-estimate) risk estimates are summarized below.

- The ELCR and HI for site worker exposure to sludge in SWMU 23 were 5×10^{-6} and 0.006, respectively. The major contributor to the ELCR is benzo(a)pyrene. The ELCR and HI for construction worker exposure to subsurface soil in SWMU 23 were 8×10^{-7} and 0.1, respectively. The calculated risks for the trespasser exposure to sludge at SWMU 23. The ELCR for this scenario is 8×10^{-6} and the HI is 0.02. The ELCR for site worker and trespasser exposures are within the target range of 1×10^{-6} to 1×10^{-4}, and the ELCR for construction worker exposure is below the target range. The HIs for all the exposure scenarios are below the target of 1.

  For construction worker exposure to groundwater at SWMU 23, none of the COCs in groundwater are carcinogenic by the applicable exposure routes, so there is no ELCR calculated for this scenario. The HI is 0.0004, which is well below the target of 1 for toxic effects.

- The ELCR and HI for site worker exposure to surface soil in SWMU 24 were 1×10^{-5} and 0.02, respectively. The major contributor to the ELCR is benzo(a)pyrene. The ELCR and HI for site worker exposure to sludge in SWMU 24 were 5×10^{-8} and 0.07, respectively. The ELCR and HI for trespasser exposure to surface soil at SWMU 24 were 1×10^{-6}, and 0.01, respectively. The ELCR and HI for trespasser exposure to sludge at SWMU 24 were 3×10^{-13}, and 0.03, respectively. The ELCRs are within or less than the target range of 1×10^{-6} to 1×10^{-4}, and the HIs are below the target of 1. The ELCR and HI for site worker exposure to sludge in SWMU 39 were 5×10^{-13} and 0.04, respectively. The ELCR and HI for trespasser exposure to sludge in SWMU 39 were 3×10^{-15} and 0.02, respectively. The ELCR for site worker exposure is within the target range of 1×10^{-6} to 1×10^{-4}, and the ELCR for a trespasser is below the target range. The HIs for both site worker and trespasser exposures are below the target of 1.

  The ELCR and HI for construction worker exposure to groundwater at SWMUs 38 and 39 are 2×10^{-9} and 0.002, respectively. Both the ELCR and HI for construction worker exposure to groundwater at SWMUs 38 and 39 are below the target values.

Risk-based RGOs were calculated for the exposure scenarios where the ELCR exceeded 1 x 10^{-6}. RGOs for non-carcinogenic risks were unnecessary because all of the HQs and HIs were below 1. Following USEPA (1996a) guidelines, RGOs were presented at ELCR target risk levels corresponding to 10^{-4}, 10^{-5}, and 10^{-6}.

None of the constituent EPC concentrations exceeded the RGO at a 1 x 10^{-5} risk level. Benzo(a)pyrene and benzo(a)anthracene EPC concentrations exceeded a 1 x 10^{-6} risk level. The benzo(a)pyrene EPC in SWMU 24 surface soil is 6.9 mg/kg, while the RGO is 0.76 mg/kg. The benzo(a)anthracene EPC in SWMU 24 surface soil is 1.6 mg/kg while the RGO for site worker exposure is 0.76 mg/kg. An RGO for lead of 1,400 mg/kg also was calculated. The lead EPC (1,700 mg/kg) exceeds the calculated RGO for sludge in SWMU 24.

Monte Carlo Analysis (probabilistic risk estimate) was conducted for the exposure scenarios where the total excess lifetime cancer risks from the deterministic (i.e., point estimate) calculations exceeded the lower end (1×10^{-6}) of the range of acceptable risk values (10^{-6} to 10^{-4}). Only the cancer risks were included in the Monte Carlo Analysis since the deterministic non-cancer risks were all acceptable (i.e., HI less than 1).

The results of the Monte Carlo Analysis indicated that the 95th percentile values all lie below or slightly exceed the lower end of the range of acceptable cancer risk (10^{-6} to 10^{-4}); the median and mean values all lie below this level. Only site worker exposure to sludge in SWMU 24 (1×10^{-6}) and surface soil in SWMU 24 (2×10^{-6}) equaled or exceeded the lower end of the acceptable range using the 95th percentile values. Typically, the median value is used to represent average exposure conditions while the 95th percentile is used to represent RME conditions.

The ecological risk assessment evaluated potential ecosystem effects based on potential ecological receptor exposure to constituents in soil and sludge at SWMU 23 and SWMUs 38 and 39. SWMU 24 was found to contain limited habitat to support ecological receptors and, therefore, was not evaluated as part of the ecological assessment. The cottontail rabbit, a herbivorous terrestrial species, was used as an indicator species to evaluate potential ecosystem effects. Exposure pathways evaluated for the indicator species included direct exposure to constituents via soil and sludge ingestion and indirect exposure to constituents via ingestion of vegetation at the SWMUs. The results of the ecological risk assessment are summarized below:

- An Ecological Inventory was conducted to collect data on:
  - biotic communities present on the site and surrounding areas;
  - the presence of species of special concern;

- evidence of biological and/or chemical stress; and
- evidence of the potential for algal blooms.

- Based on the ecological assessment, constituent concentrations detected in the soil at the SWMUs are unlikely to present a risk to ecological receptors. There is the potential for unacceptable risks for herbivorous terrestrial species exposed to sludge at the SWMUs.

6.0 RECOMMENDATIONS

The following recommendations for additional investigations are based upon the data presented in Section 4.0 and the risk assessment presented in Section 5.0 of this report. Recommendations were developed and are discussed on a SWMU basis.

6.1 BIOLOGICAL SLUDGE DISPOSAL AREA (SWMU 23)

Due to the low levels of detected constituents and the findings of the risk assessment, no further action is recommended for SWMU 23.

6.2 BLAST FURNACE EMISSIONS CONTROL SLUDGE WASTE PILE (SWMU 24)

Due to the low levels of detected constituents and the findings of the risk assessment, no further action relative to soil investigations are recommended at SWMU 24.

A groundwater investigation will be conducted at SWMU 24 to assess the presence/absence of groundwater contamination upgradient, sidegradient, and downgradient of this SWMU. Since the flue dust in SWMU 24 is being mined, a monitor well cannot be installed in the SWMU 24 area. Monitor wells MW-2, MW-8, MW-9, MW-13S, and MW-13D, which are located in the BTF area, will be used to characterize the groundwater downgradient of SWMU 24. Additionally, Sloss proposes to install an additional shallow monitor well downgradient of SWMU 24 between MW-9 and MW-13S/13D at the location presented on Figure 6-1. The proposed monitor well location is approximate and will be finalized pending field evaluation of site access. Monitor wells MW-21, MW-25S, MW-25D, MW-26 and MW-36 will be used to characterize upgradient and sidegradient groundwater in the vicinity of SWMU 24. The proposed shallow monitor well will be installed and developed in accordance with the approved RFI Work Plan.

Groundwater samples will be collected from the proposed monitor well and analyzed for VOCs (USEPA Method 8270), SVOCs (USEPA Method 8270), PP metals, barium, and cyanide. All groundwater sampling will be performed in accordance with the approved site Work Plan. In addition, groundwater quality data collected from existing monitor wells MW-2, MW-8, MW-9, MW-13S, MW-13D, MW-21, MW-25S, MW-25D, MW-26 and MW-36 during previous RFI investigations will used in the groundwater assessment.

6.3 LANDFILL AND BLAST FURNACE EMISSION CONTROL SLUDGE WASTE PILE LANDFILL (SWMUS 38 AND 39)

Due to the low levels of detected constituents, the findings of the risk assessment, and the proposed mining/removal activities for SWMU 39, no further action is recommended for soil at SWMUs 38 or 39.

During Phase II of the SWMU 38 and 39 RFI, Sloss proposes to further define the extent of the horizontal groundwater contamination at locations where groundwater contamination is in excess of MCLs. During Phase I of the SWMU 38 and 39 RFI, benzene was detected above the MCL at monitor wells MW-26 and MW-34D installed in the deep Conasauga and cyanide was above the MCL at monitor wells MW-32 and MW-34S installed in the shallow Conasauga.

In June 1999, during the Chemical Manufacturing Plant RFI and BTF RFI Addendum investigations, monitor wells MW-26, MW-32, MW-34D, and MW-34S were resampled to confirm the 1997 sampling results. Groundwater samples collected from monitor wells MW-26 and MW-34D were analyzed for VOCs and groundwater samples collected from MW-32 and MW-34S were analyzed for cyanide. The resampling results, which were presented in the November 19, 1999 Response to Comments Addendum, confirmed that the concentrations of benzene detected in MW-26 and cyanide detected in MW-32 remained above EPA MCLs. However, benzene previously detected in MW-

34D was not detected in June 1999. Additionally, the concentration of cyanide detected in MW-34S was below the EPA MCL in June 1999.

During the Phase II RFI, additional monitor wells will be installed in the shallow Conasauga aquifer in the vicinity of MW-32 and in the deep Conasauga aquifer in the vicinity of MW-26. Two shallow monitor wells will be installed in the vicinity of MW-32, one upgradient and one downgradient, at the approximate locations presented in Figure 6-1. These monitor wells will be installed to assess the horizontal extent of cyanide contamination in the shallow Conasauga aquifer. In the deep Conasauga, Sloss proposes to install two monitor wells in the vicinity of MW-26, one upgradient and one downgradient, at the approximate locations presented in Figure 6-1. These monitor wells will be installed to assess the horizontal extent of benzene in the deep Conasauga.

The additional shallow and deep monitor wells will be installed to the same depth as the well being investigated. The proposed monitor well locations are approximate and will be finalized pending negotiation of access agreements with off site property owners and field evaluation of site access. The monitor wells will be installed and developed in accordance with the approved RFI Work Plan. Groundwater samples will be collected from MW-32 and the two proposed shallow monitor wells in accordance with the approve RFI Work Plan and analyzed for cyanide. Groundwater samples will be collected from MW-26 and the two proposed deep wells and analyzed for VOCs (USEPA Method 8260).

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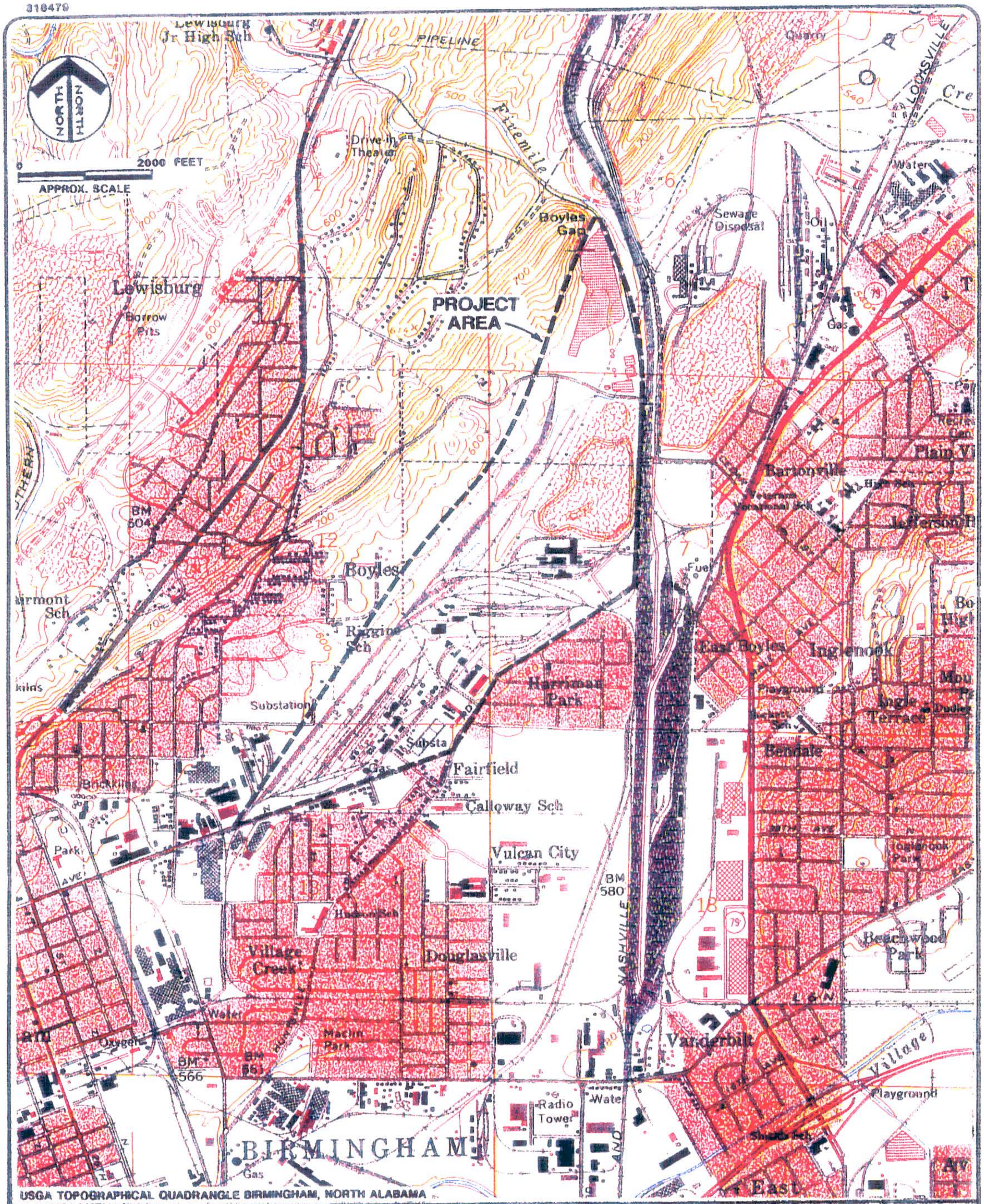
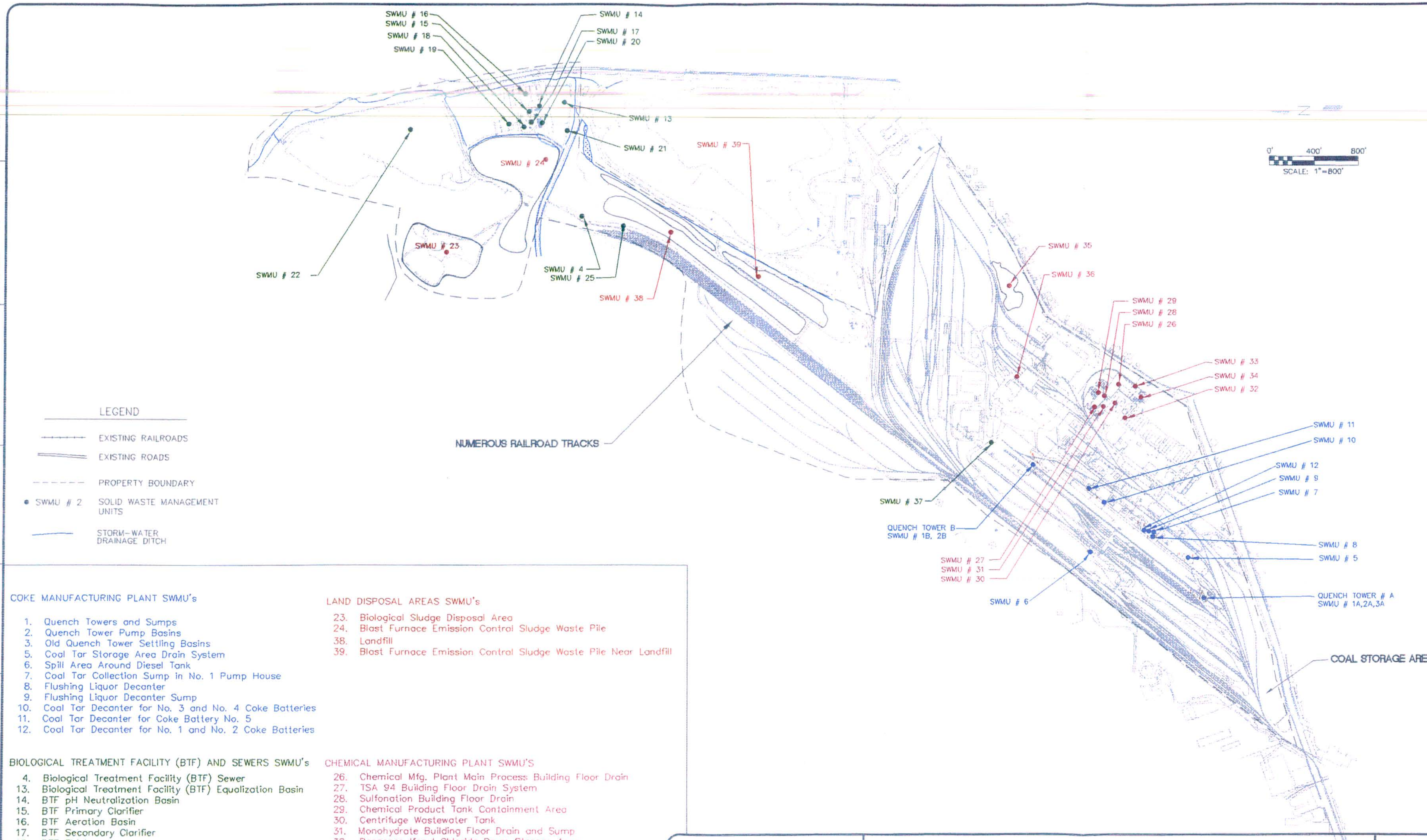


PROJECT LOCATION MAP

SLOSS INDUSTRIES, CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 1-1

GERAGHTY & MILLER, INC.
Environmental Services



COKE MANUFACTURING PLANT SWMU's

1. Quench Towers and Sumps
2. Quench Tower Pump Basins
3. Old Quench Tower Settling Basins
5. Coal Tar Storage Area Drain System
6. Spill Area Around Diesel Tank
7. Coal Tar Collection Sump in No. 1 Pump House
8. Flushing Liquor Decanter
9. Flushing Liquor Decanter Sump
10. Coal Tar Decanter for No. 3 and No. 4 Coke Batteries
11. Coal Tar Decanter for Coke Battery No. 5
12. Coal Tar Decanter for No. 1 and No. 2 Coke Batteries

BIOLOGICAL TREATMENT FACILITY (BTF) AND SEWERS SWMU's

4. Biological Treatment Facility (BTF) Sewer
13. Biological Treatment Facility (BTF) Equalization Basin
14. BTF pH Neutralization Basin
15. BTF Primary Clarifier
16. BTF Aeration Basin
17. BTF Secondary Clarifier
18. BTF Thickener
19. BTF Digester
20. Dewatering Machine
21. BTF Emergency Basin
22. Polishing Pond
25. Storm Water Runoff Sewer
37. BTF Sewer Tar Trap

LAND DISPOSAL AREAS SWMU's

23. Biological Sludge Disposal Area
24. Blast Furnace Emission Control Sludge Waste Pile
38. Landfill
39. Blast Furnace Emission Control Sludge Waste Pile Near Landfill

CHEMICAL MANUFACTURING PLANT SWMU'S

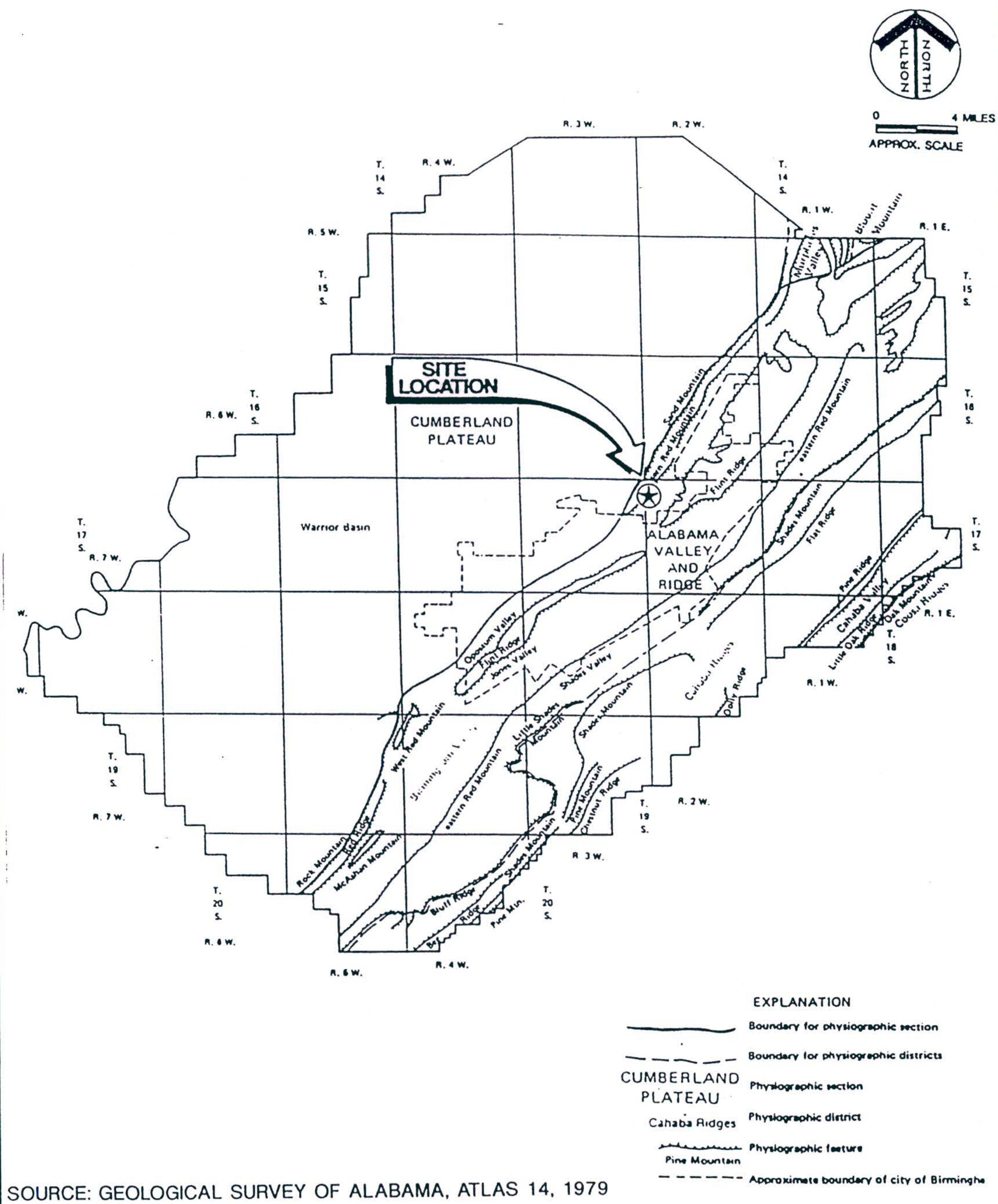
26. Chemical Mfg. Plant Main Process Building Floor Drain
27. TSA 94 Building Floor Drain System
28. Sulfonation Building Floor Drain
29. Chemical Product Tank Containment Area
30. Centrifuge Wastewater Tank
31. Monohydrate Building Floor Drain and Sump
32. Benzenesulfonyl Chloride Drum Storage Area
33. Benzenesulfonyl Chloride Plant Drum Storage Area
34. Benzenesulfonyl Chloride Wastewater Neutralization System
35. Old Waste Pile at Mineral Wool Plant
36. Maintenance Shop Used Oil Tank

GERAGHTY & MILLER, INC.
Environmental Services

FACILITY PLAN
LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 1-2

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SL095.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH

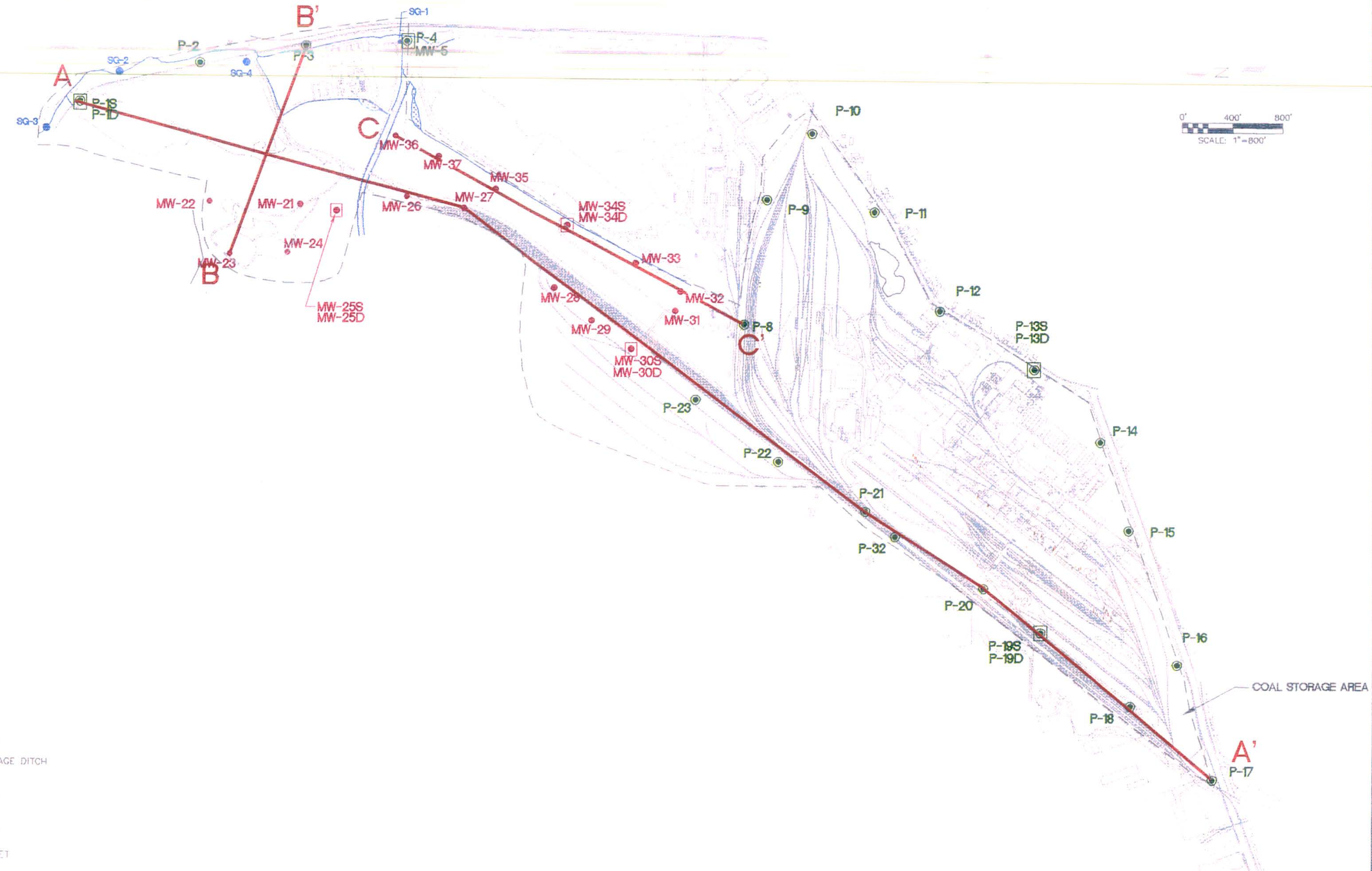


SOURCE: GEOLOGICAL SURVEY OF ALABAMA, ATLAS 14, 1979

GERAGHTY & MILLER, INC.
Environmental Services

TOPOGRAPHIC FEATURES AND PHYSIOGRAPHIC SECTION MAP
LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-1



LEGEND

- EXISTING RAILROADS
- EXISTING ROADS
- PROPERTY BOUNDARY
- STORM-WATER DRAINAGE DITCH
- P-61 SINGLE PIEZOMETERS
- P-1 PIEZOMETER COUPLET
- MW-21 SINGLE MONITOR WELL
- MW-25 MONITOR WELL COUPLET
- SG-3 STAFF GAUGE
- A — A' GEOLOGICAL CROSS SECTION LOCATION

GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGICAL CROSS SECTION LOCATION MAP

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-2

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SLO95.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH

	FORMATION	LITHOLOGY	THICKNESS
PENNSYLVANIAN	POTTSVILLE FORMATION (Pp)	ALTERNATING BEDS OF SANDSTONE AND SHALE WITH NUMEROUS COAL SEAMS AND ASSOCIATED BEDS OF UNDERCLAY ORTHOQUARTZITE AND QUARTZ PEBBLE CONGLOMERATE OCCUR AT BASE	100 TO 2800 FEET
	PARKWOOD FORMATION (PMpw)	LIGHT TO MEDIUM GRAY, VERY FINE TO FINE GRAINED, ARGILLACEOUS, MICACEOUS SANDSTONE INTERBEDDED WITH MEDIUM TO DARK GRAY, FISSLE, MICAEOUS SHALE AND SILTSTONE.	0 TO 900 FEET
MISSISSIPPIAN	FLOYD SHALE (Mf)	DARK GRAY CLAY SHALE WITH LOCALLY OCCURRING THIN SILTSTONE BEDS.	0 TO 600 FEET
	BANGOR LIMESTONE (Mb)	MEDIUM BEDDED, MEDIUM TO MEDIUM LIGHT GRAY, BIOCLASTIC OR OOLITIC LIMESTONE WITH LOCALLY OCCURING ARGILACEOUS AND SUBLITHOGRAPHIC LIMESTONE AND SHALE	0 TO 500 FEET
	HARTSELLE SANDSTONE (Mh)	MEDIUM TO VERY THICK BEDDED, CLEAN, WELL SORTED, LIGHT COLORED, VERY FINE TO MEDIUM GRAINED, CROSS-BEDDED, QUARTZ SANDSTONE.	0 TO 120 FEET
	PRIDE MOUNTAIN FORMATION (Mpm)	DARK GRAY, FISSLE, CLAY SHALE WITH THIN SANDSTONE AND SILTSTONE BEDS. BASAL OOLITIC LIMESTONE BED. CLAY SHALE INDISTINGUISHIBLE FROM THE FLOYD SHALE.	120 TO 400 FEET
	TUSCUMBIA LIMESTONE (Mt)	THICK BEDDED, MEDIUM DARK TO MEDIUM GRAY CRYSTALLINE, OOLITIC SUBLITHOGRAPHIC AND BIOCLASTIC LIMESTONE WITH MINOR AMOUNTS OF CHERT.	70 TO 110 FEET
	FORT PAYNE CHERT (Mfp)	GRAYISH ORANGE TO LIGHT GRAY, BEDDED, FOSSILIFEROUS CHERT. GENERALLY HIGHLY WEATHERED IN OUTCROP. GREENISH-GRAY TO GRAYISH RED THINLY LAMINATED SHALE COMMONLY OCCURS AT BASE (MAURY FORMATION).	90 TO 200 FEET
DEVONIAN	CHATTANOOGA SHALE (Dc)	BROWNISH-BLACK, FISSLE, SILTY SHALE.	0 TO 10 FEET
	FROG MOUNTAIN SANDSTONE (Dfm)	MEDIUM TO THICK BEDDED, DUSKY RED AND LIGHT TO DARK GRAY, COARSE GRAINED, HEMATITIC SANDSTONE AND LIGHT TO DARK GRAY HEMATITIC SANDSTONE AND PEBBLE CONGLOMERATE.	0 TO 36 FEET
	DEVONIAN UNDIFFERENTIATED (Du)	LIGHT OLIVE GRAY TO WHITE TO YELOWISH GRAY, FINELY CRYSTALLINE SILICEOUS, CHERTY, GLAUCONITIC, DOLOMITIC LIMESTONE	0 TO 120 FEET
SILURIAN	RED MOUNTAIN FORMATION (Srm)	DARK-REDISH-BROWN TO OLIVE GRAY SILTSTONE, SANDSTONE, OCCASIONAL THIN BED OF LIMESTONE, AND SHALE WITH HEMATITE BEDS 5-30 FEET THICK.	200 TO 500 FEET
ORDOVICIAN	CHICKAMAUGA LIMESTONE (Oc)	THIN TO MEDIUM BEDDED SUBLITHOGRAPHIC LIMESTONE WITH SOME ARGILLACEOUS AND CRYSTALLINE LIMESTONE, SHALE, AND BENTONITE INTERBEDS. BASAL CHERT CONGLOMERATE PRESENT(ATTALLA CHERT).	200 TO 500 FEET
	KNOX GROUP UNDIFFERENTIATED (OCk)	THICK BEDDED, MEDIUM TO LIGHT GRAY CHERTY DOLOMITE WITH LESSER AMOUNT OF LIMESTONE AND DOLOMITIC LIMESTONE	1500 TO 3000 FEET
CAMBRIAN	KETONA DOLOMITE (Ckt)	THICK BEDDED, LIGHT BROWNISH GRAY TO YELLOWISH GRAY, CRYSTALLINE DOLOMITE.	0 TO 600 FEET
	CONASAUGA FORMATION (Cc)	THIN BEDDED, DARK TO BROWNISH GRAY, SUBLITHOGRAPHIC SHALEY LIMESTONE	1100 TO 1900 FEET

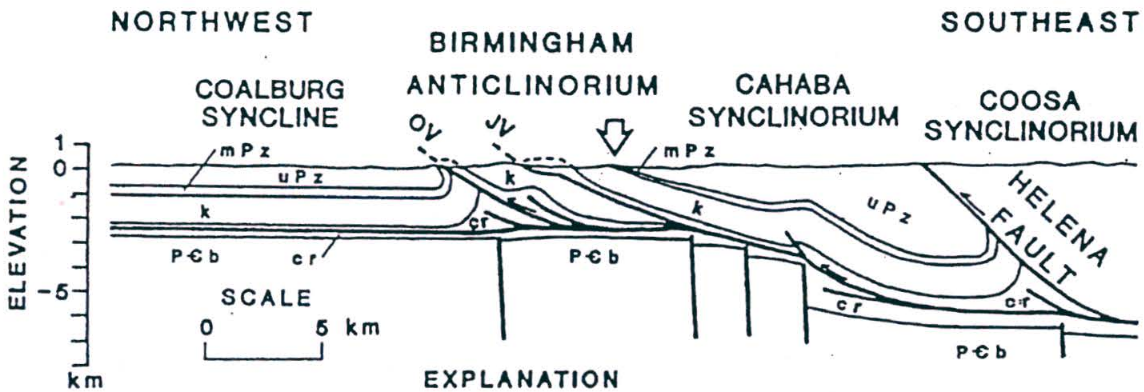
GERAGHTY & MILLER, INC.
Environmental Services

GENERALIZED GEOLOGIC STRATIGRAPHIC SECTION

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE
2-3

DWG DATE: 12/5/97 | PRJCT NO.: X | FILE NO.: SLOSS | DRAWING: SLO-LITH.DWG | CHECKED: JH | APPROVED: PF | DRAFTER: BJH



EXPLANATION

uPz	MISSISSIPPIAN-PENNSYLVANIAN
mPz	MIDDLE-UPPER ORDOVICIAN, SILURIAN
k	CAMBRIAN-ORDOVICIAN KNOX GROUP
cr	CAMBRIAN ROME AND CONASAUGA FORMATIONS
P€b	PRECAMBRIAN BASEMENT ROCKS
OV	OPOSSUM VALLEY FAULT
JV	JONES VALLEY FAULT

LOCATION OF RED MOUNTAIN EXPRESSWAY

SOURCE: THOMAS AND BEARCE, 1986

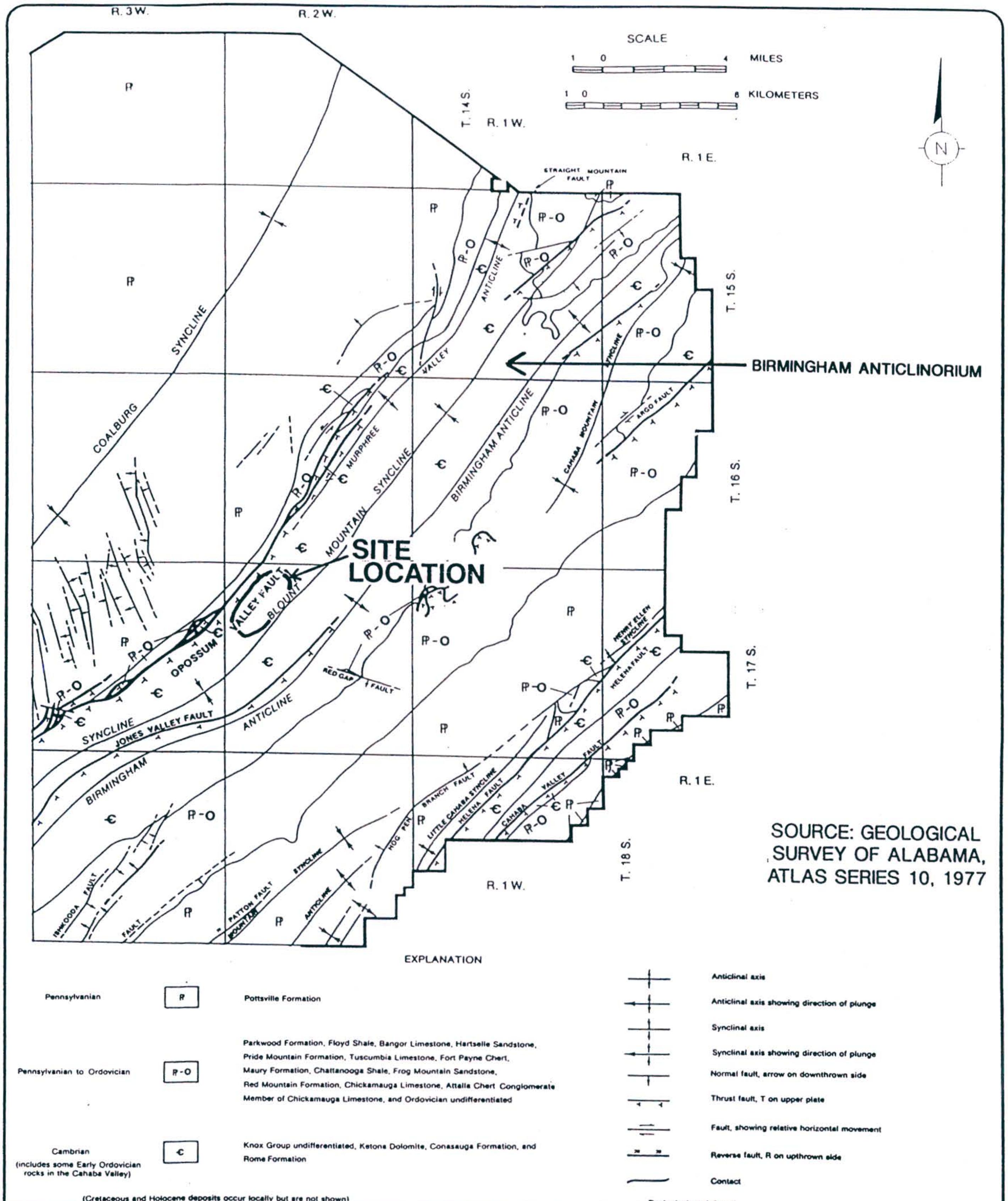
GERAGHTY & MILLER, INC.
Environmental Services

STRUCTURAL CROSS SECTION OF THE VALLEY AND RIDGE PROVINCE

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE

2-4



GERAGHTY & MILLER, INC.
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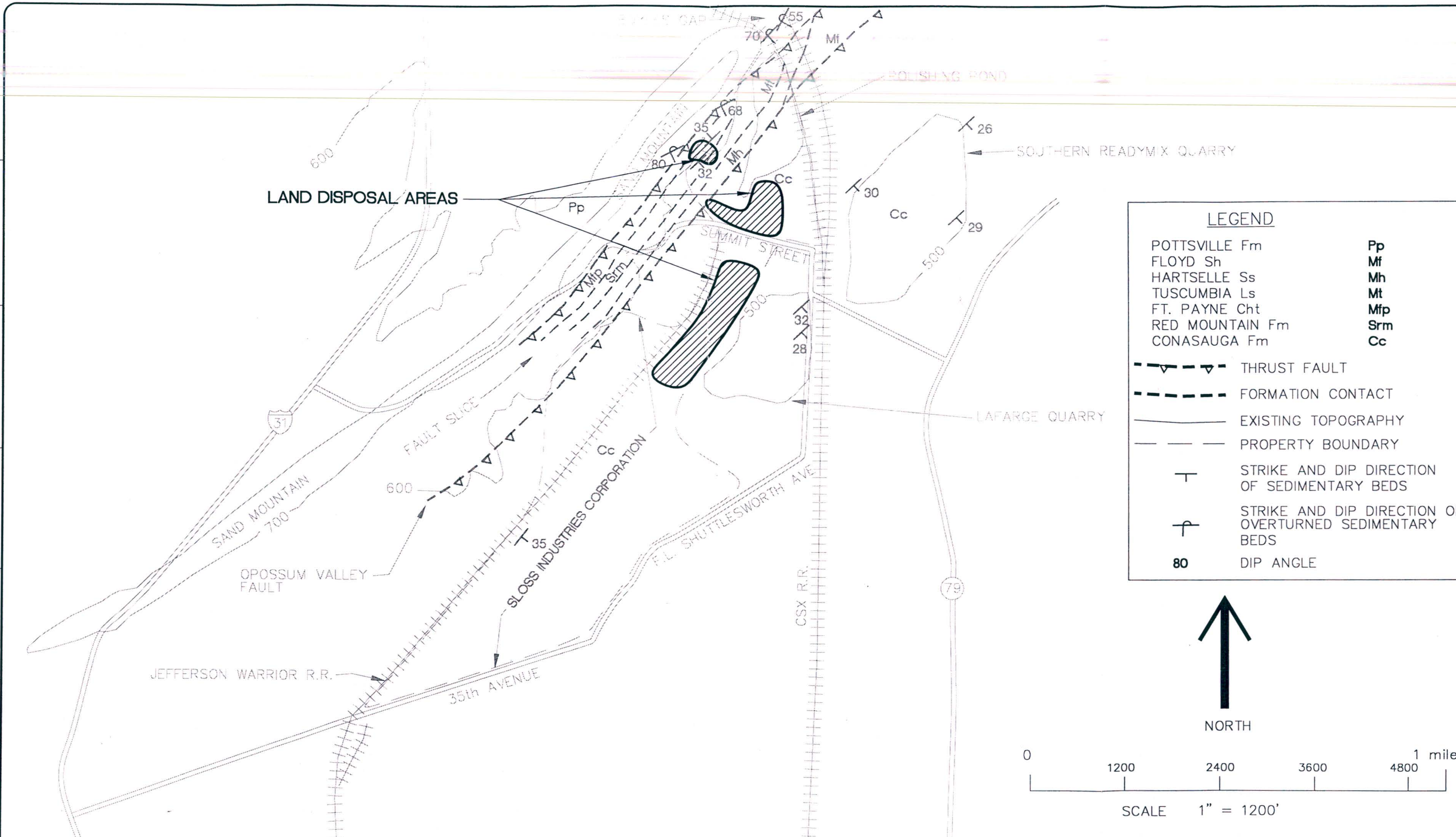
GENERALIZED GEOLOGY OF EASTERN JEFFERSON COUNTY, ALABAMA

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-5



GEOLOGY OF THE SLOSS PROPERTY AND VICINITY

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES
BIRMINGHAM, ALABAMA

FIGURE 2-6

GERAGHTY & MILLER, INC.
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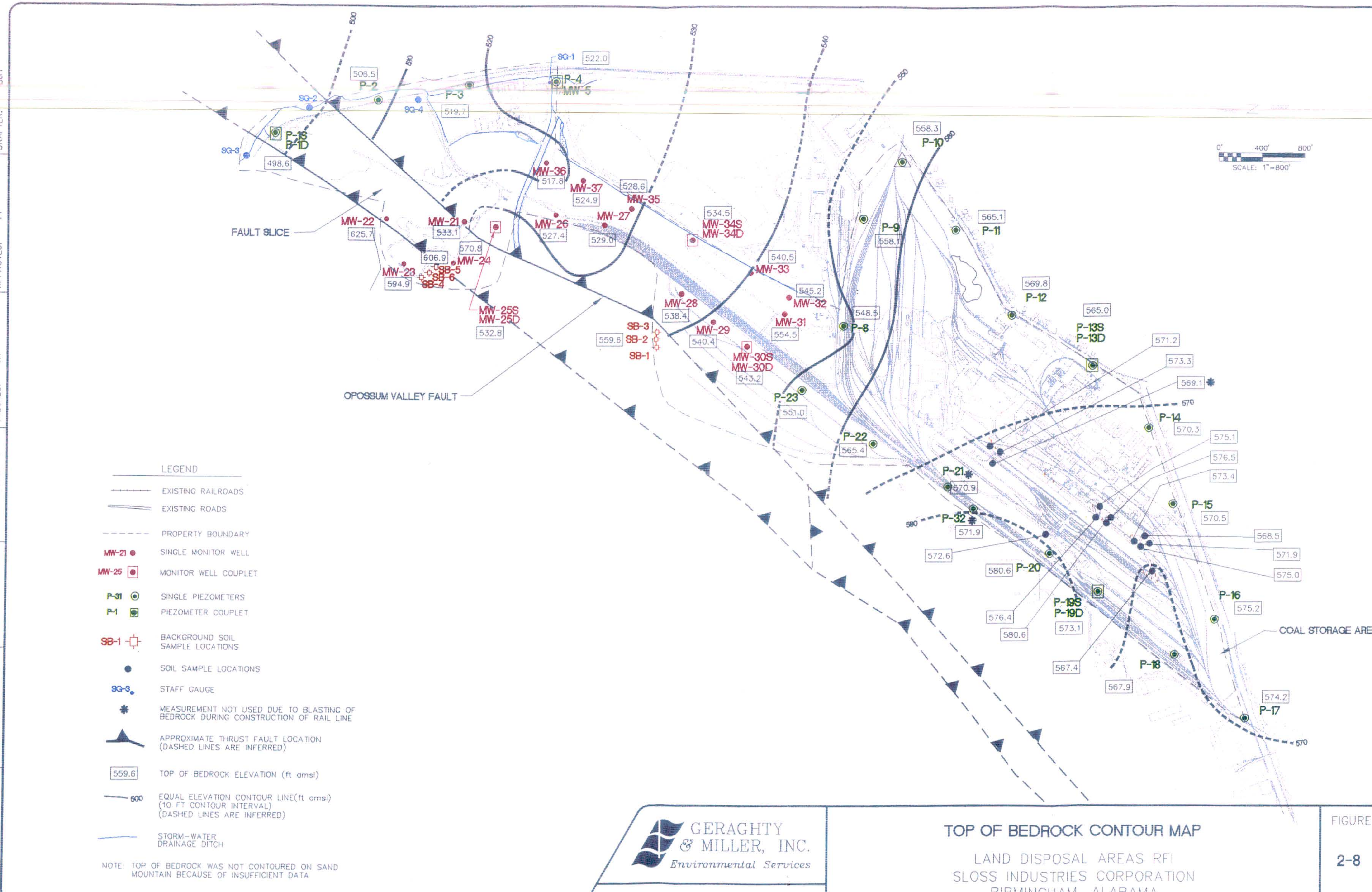
DWG DATE: 12/5/97 | PRJCT NO.: TF0318.001 | FILE NO.: SLOSS | DRAWING: SLO-GEO.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH

DWG DATE: 12/4/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SL095.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: SJH

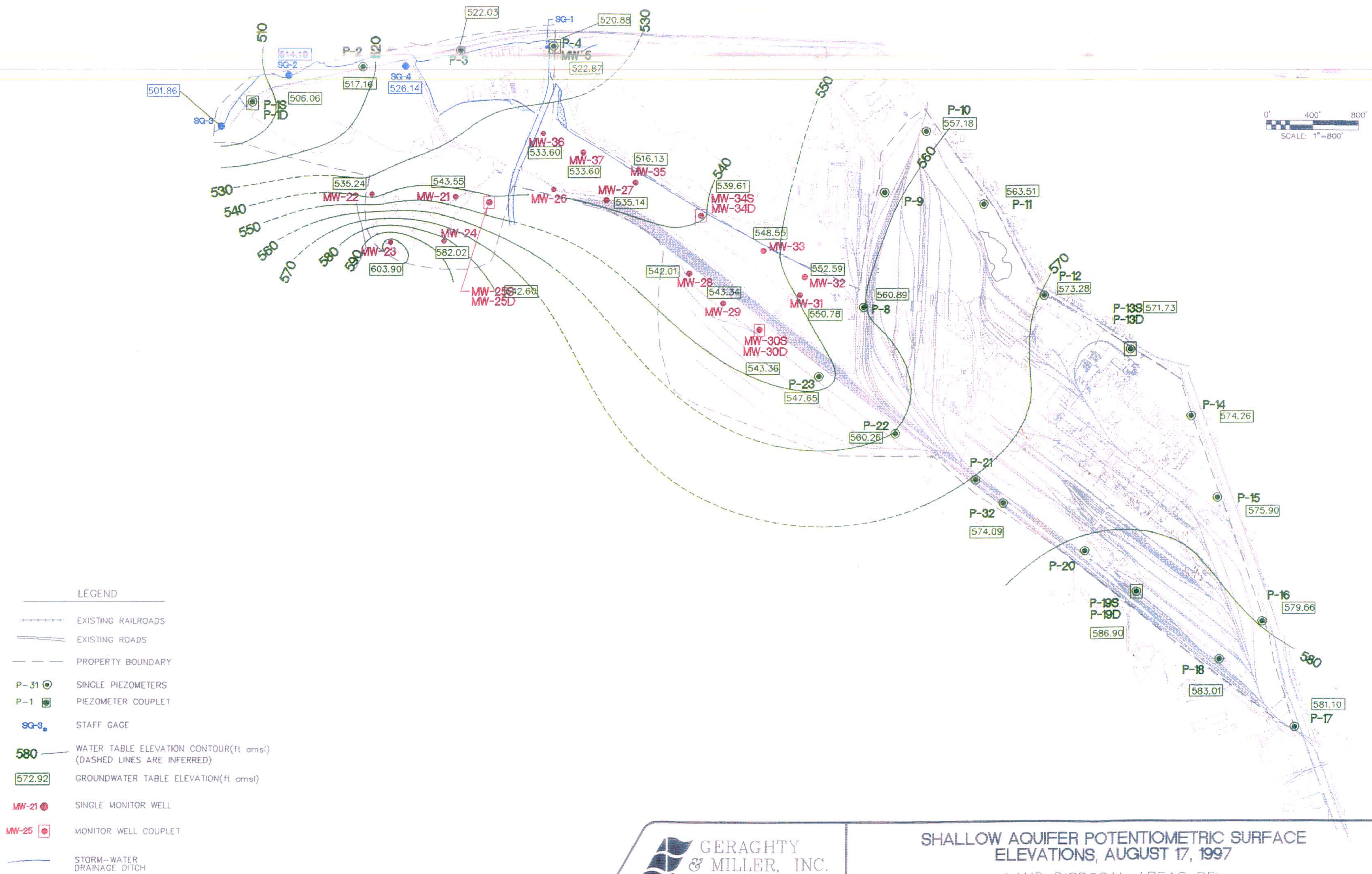


GERAGHTY & MILLER, INC.
Environmental Services

TOP OF BEDROCK CONTOUR MAP

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-8



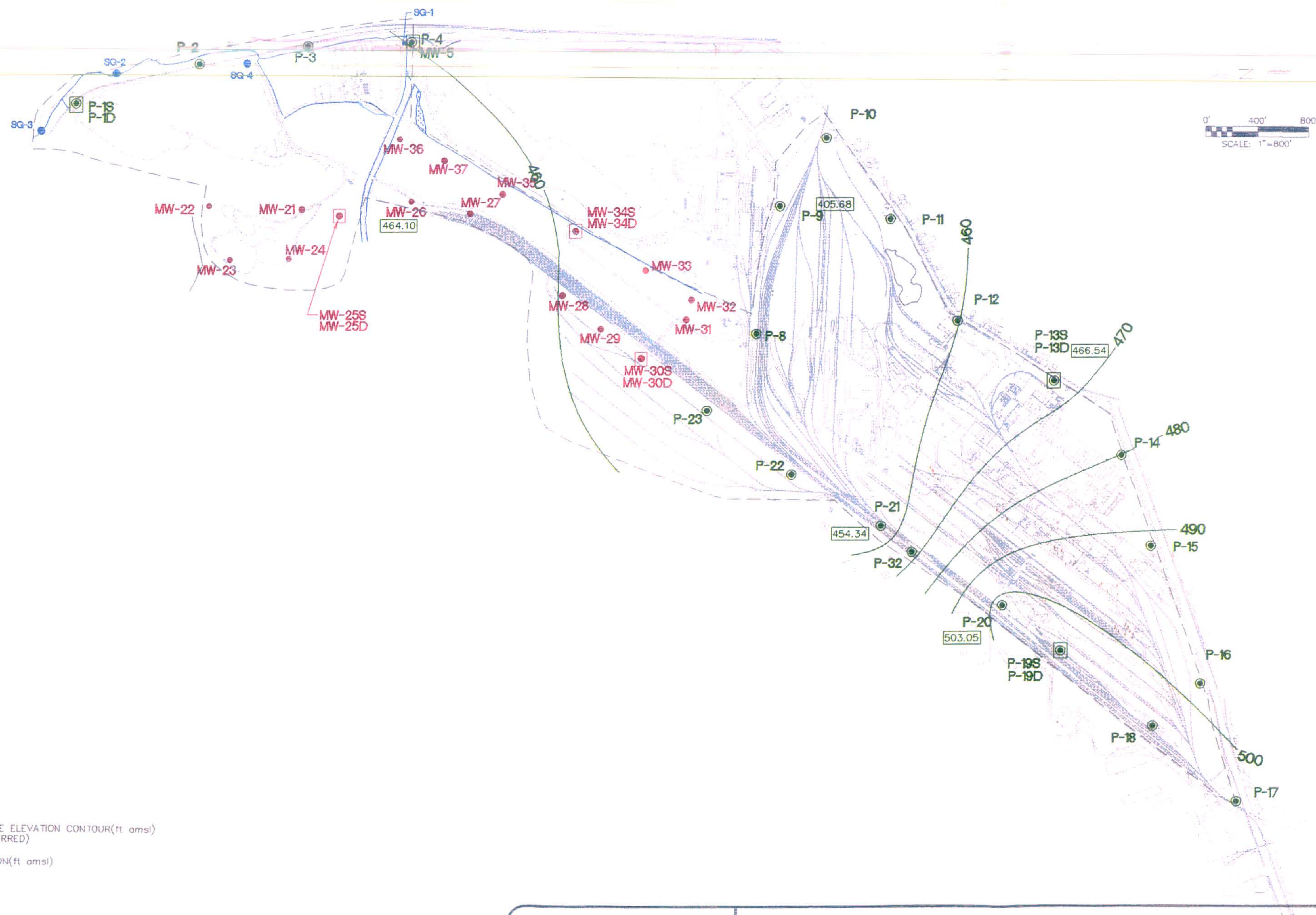
GERAGHTY & MILLER, INC.
Environmental Services

SHALLOW AQUIFER POTENTIOMETRIC SURFACE ELEVATIONS, AUGUST 17, 1997

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-9

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SLO95.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



LEGEND

EXISTING RAILROADS

EXISTING ROADS

PROPERTY BOUNDARY

P-31 SINGLE PIEZOMETERS

P-1 PIEZOMETER COUPLET

SG-3 STAFF GAGE

410 POTENTIOMETRIC SURFACE ELEVATION CONTOUR(ft amsl) (DASHED LINES ARE INFERRED)

572.92 GROUNDWATER ELEVATION(ft amsl)

MW-21 SINGLE MONITOR WELL

MW-25 MONITOR WELL COUPLET

STORM-WATER DRAINAGE DITCH

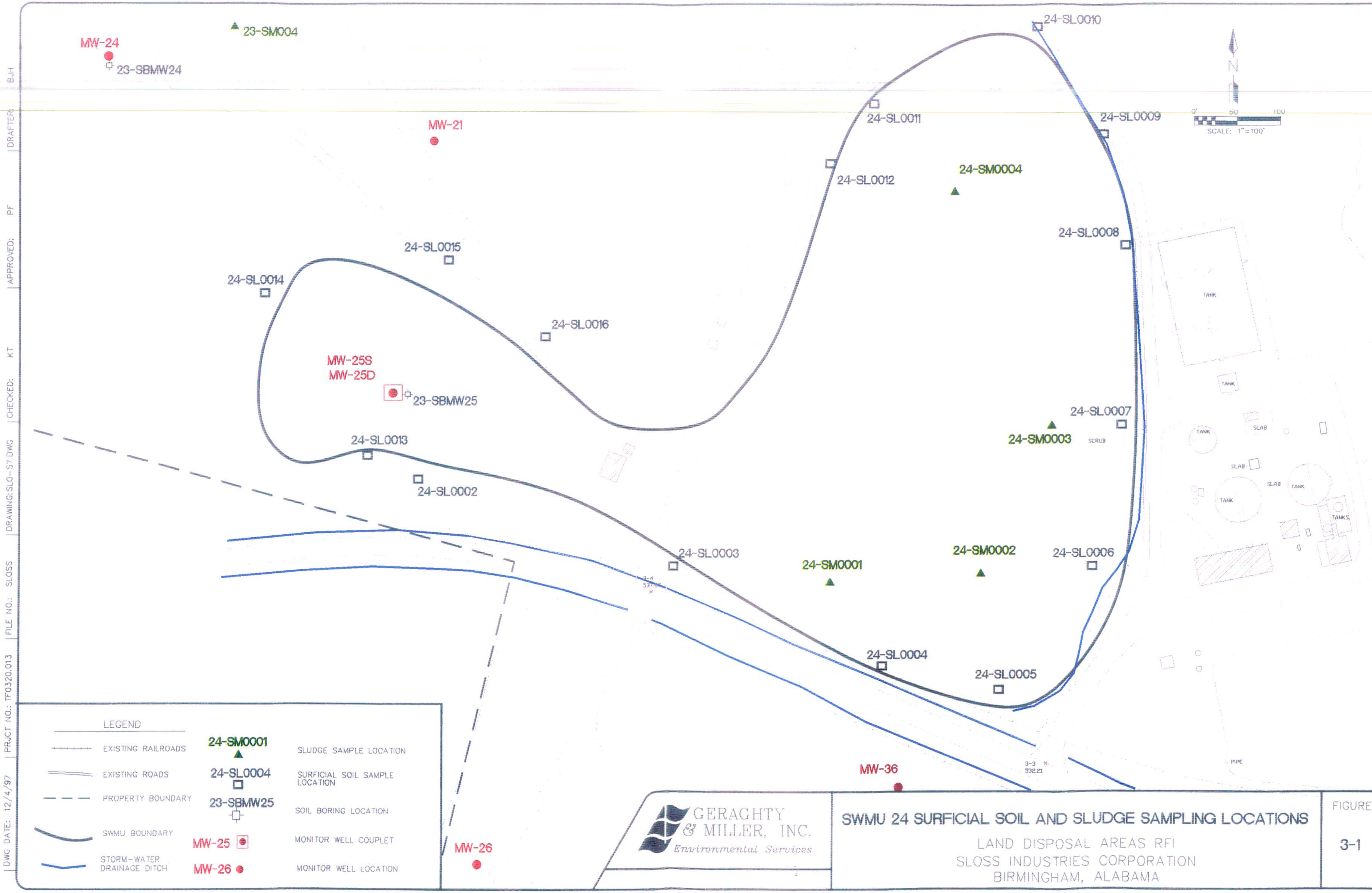
GERAGHTY & MILLER, INC.
Environmental Services

DEEP AQUIFER POTENTIOMETRIC SURFACE ELEVATIONS, AUGUST 17, 1997

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-10

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SL095.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH

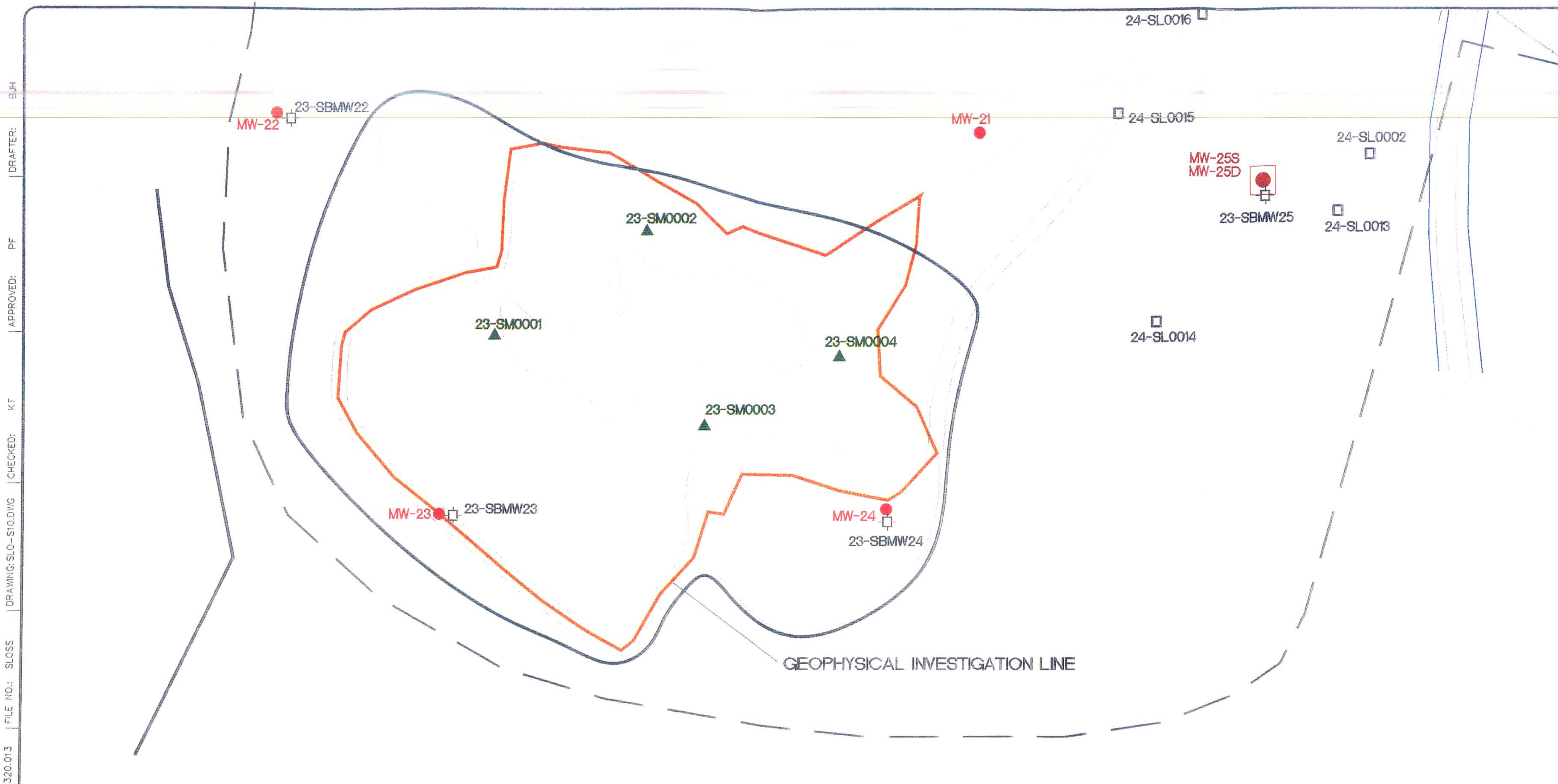


GERAGHTY & MILLER, INC.
Environmental Services

SWMU 24 SURFICIAL SOIL AND SLUDGE SAMPLING LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 3-1



LEGEND

EXISTING RAILROADS		24-SM0003	SLUDGE SAMPLE LOCATION
EXISTING ROADS		24-SL0014	SURFICIAL SOIL SAMPLING LOCATION
PROPERTY BOUNDARY		23-SBMW24	SOIL BORING LOCATION
SWMU BOUNDARY		MW-25	MONITOR WELL COUPLET
GEOPHYSICAL INVESTIGATION LINE		MW-22	MONITOR WELL LOCATION
STORM-WATER DRAINAGE DITCH			

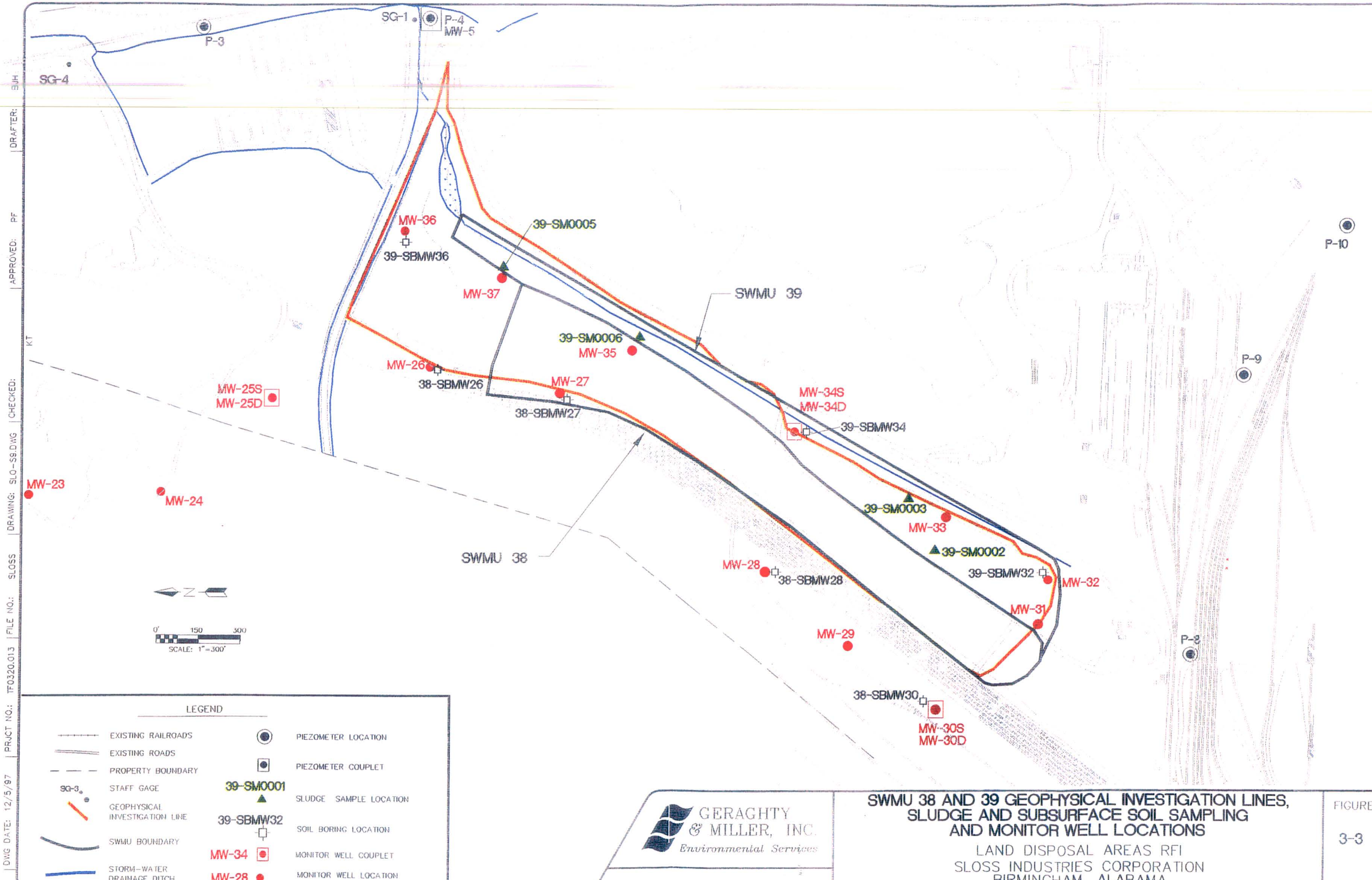
GERAGHTY & MILLER, INC.
Environmental Services

SWMU 23 GEOPHYSICAL INVESTIGATION LINES, SLUDGE AND SUBSURFACE SOIL SAMPLING AND MONITOR WELL LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE
3-2

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SLO-S10.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



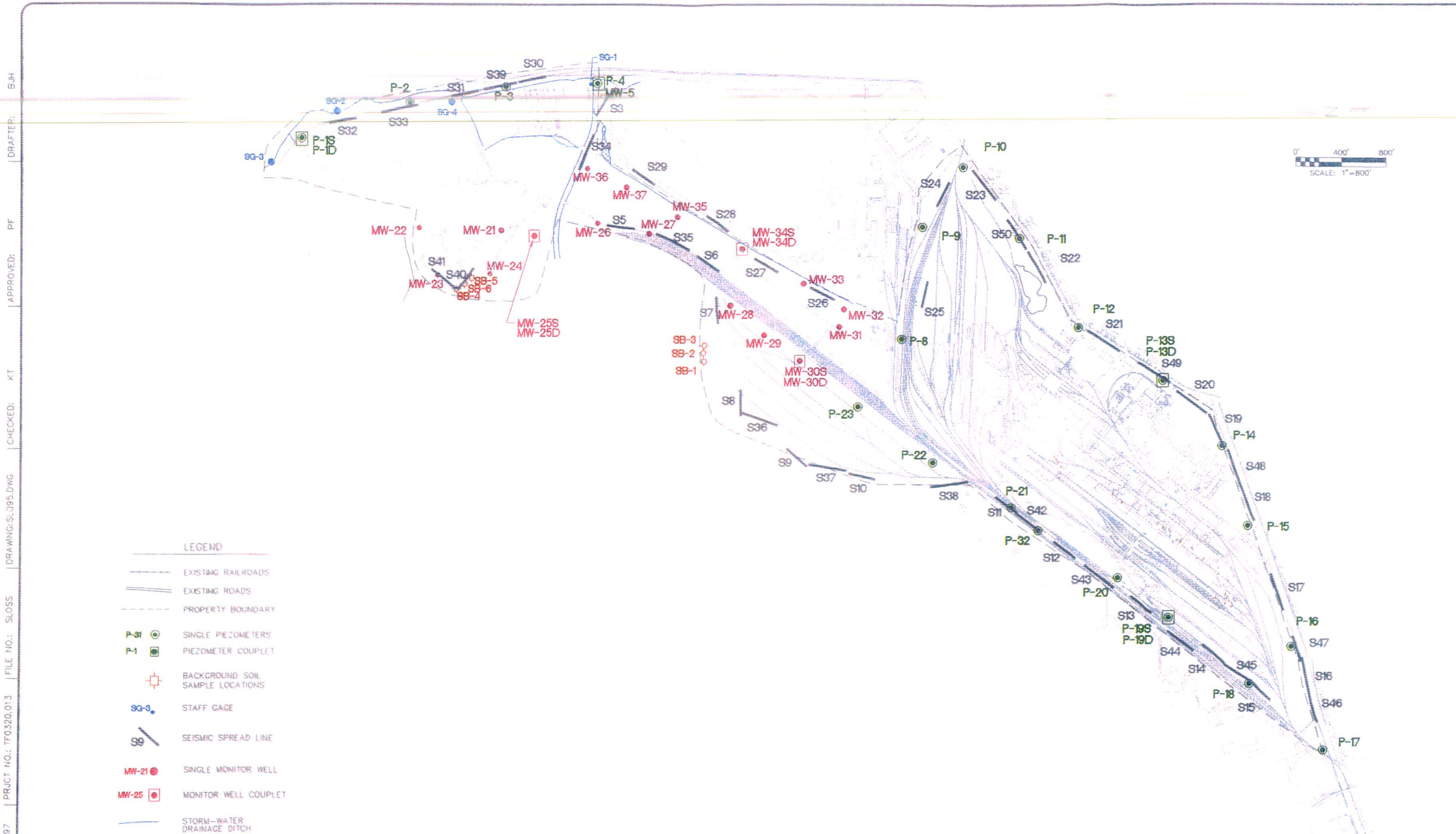
GERAGHTY & MILLER, INC.
Environmental Services

SWMU 38 AND 39 GEOPHYSICAL INVESTIGATION LINES, SLUDGE AND SUBSURFACE SOIL SAMPLING AND MONITOR WELL LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 3-3

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SLO-S9.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



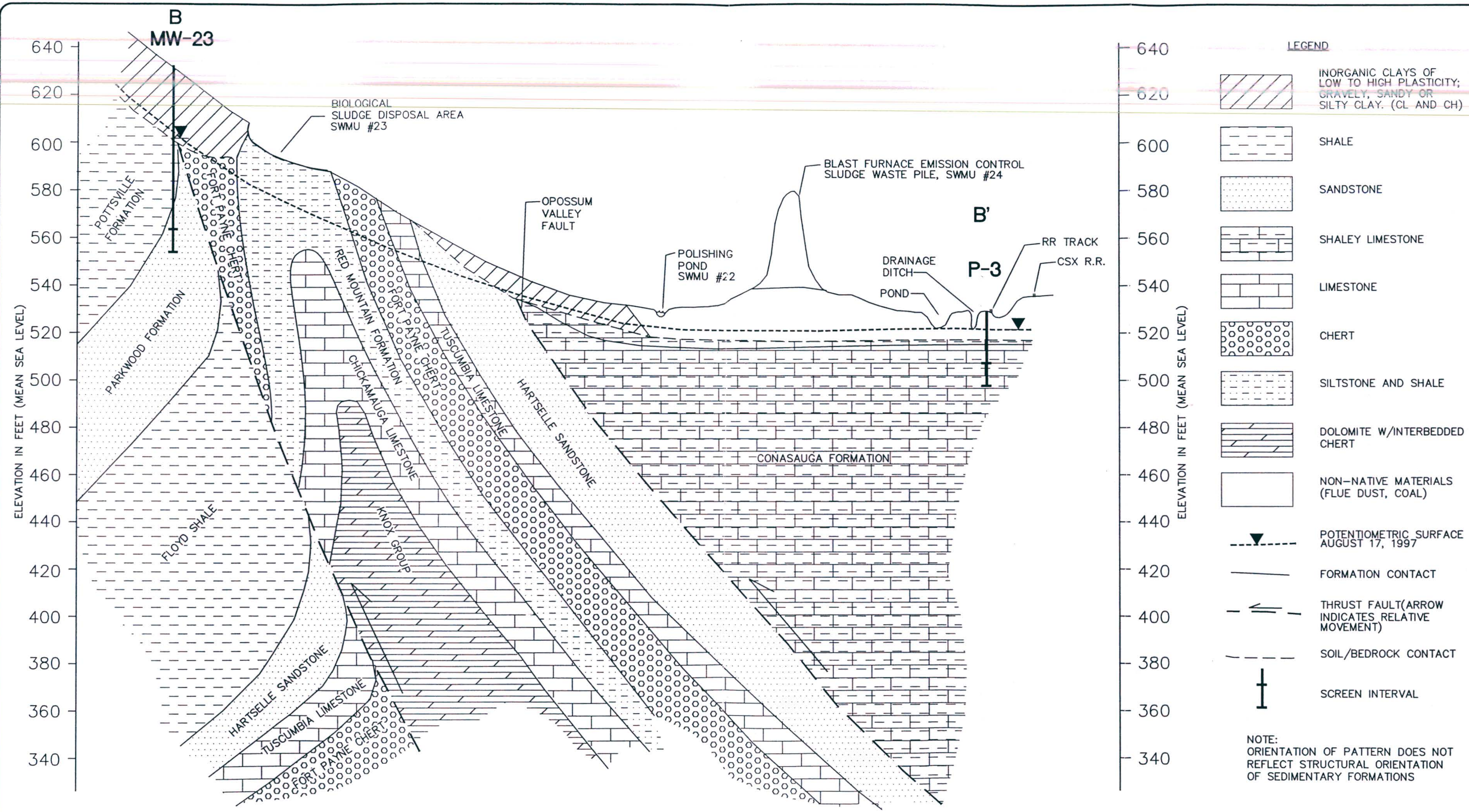
GERAGHTY & MILLER, INC.
Environmental Services

FACILITY - WIDE INVESTIGATION
SEISMIC INVESTIGATION LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 3-4

DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | FILE NO.: SLOSS | DRAWING: SL095.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



HORIZ. 1" = 200'
VERT. 1" = 40

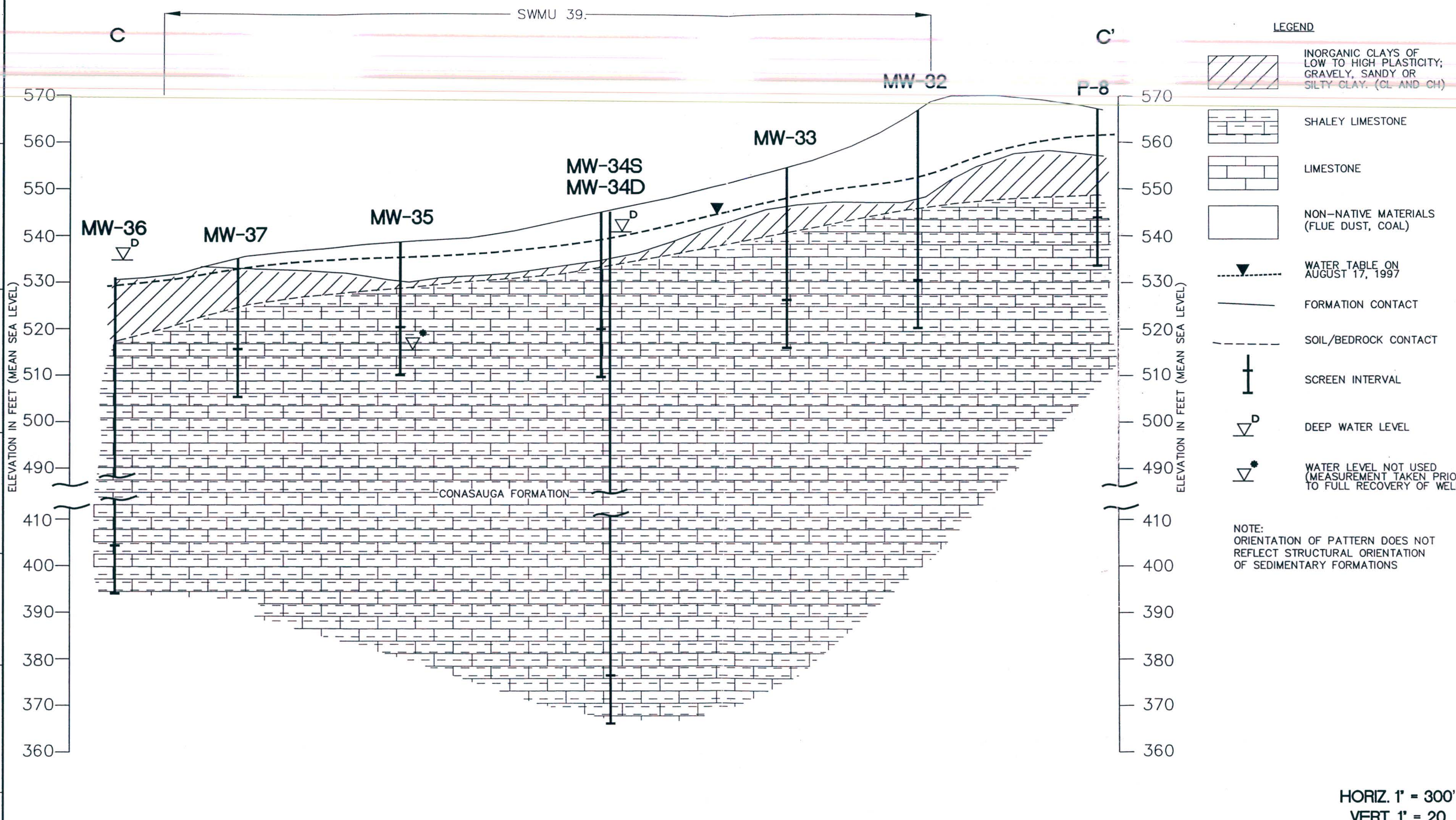
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGICAL CROSS SECTION B - B'

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE
4-1

DWG DATE: 12/5/97 | PRJCT NO.: TF0318.001 | FILE NO.: SLOSS | DRAWING: SLO-S1.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



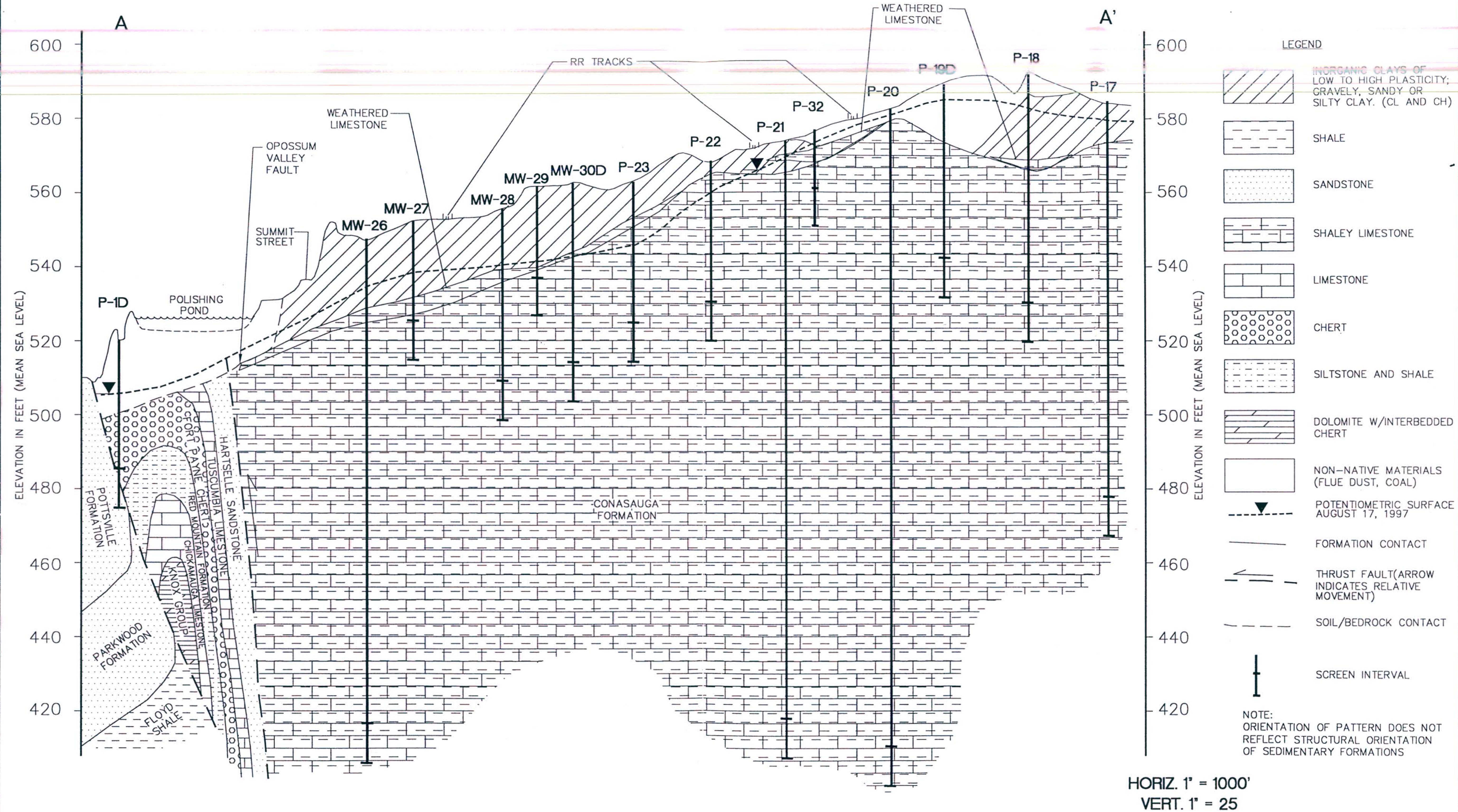
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGICAL CROSS SECTION C - C'

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE
4-2

DWG DATE: 12/5/97 | PRJCT NO.: TF0318.001 | FILE NO.: SLOSS | DRAWING: SLO-SECT.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: CJH



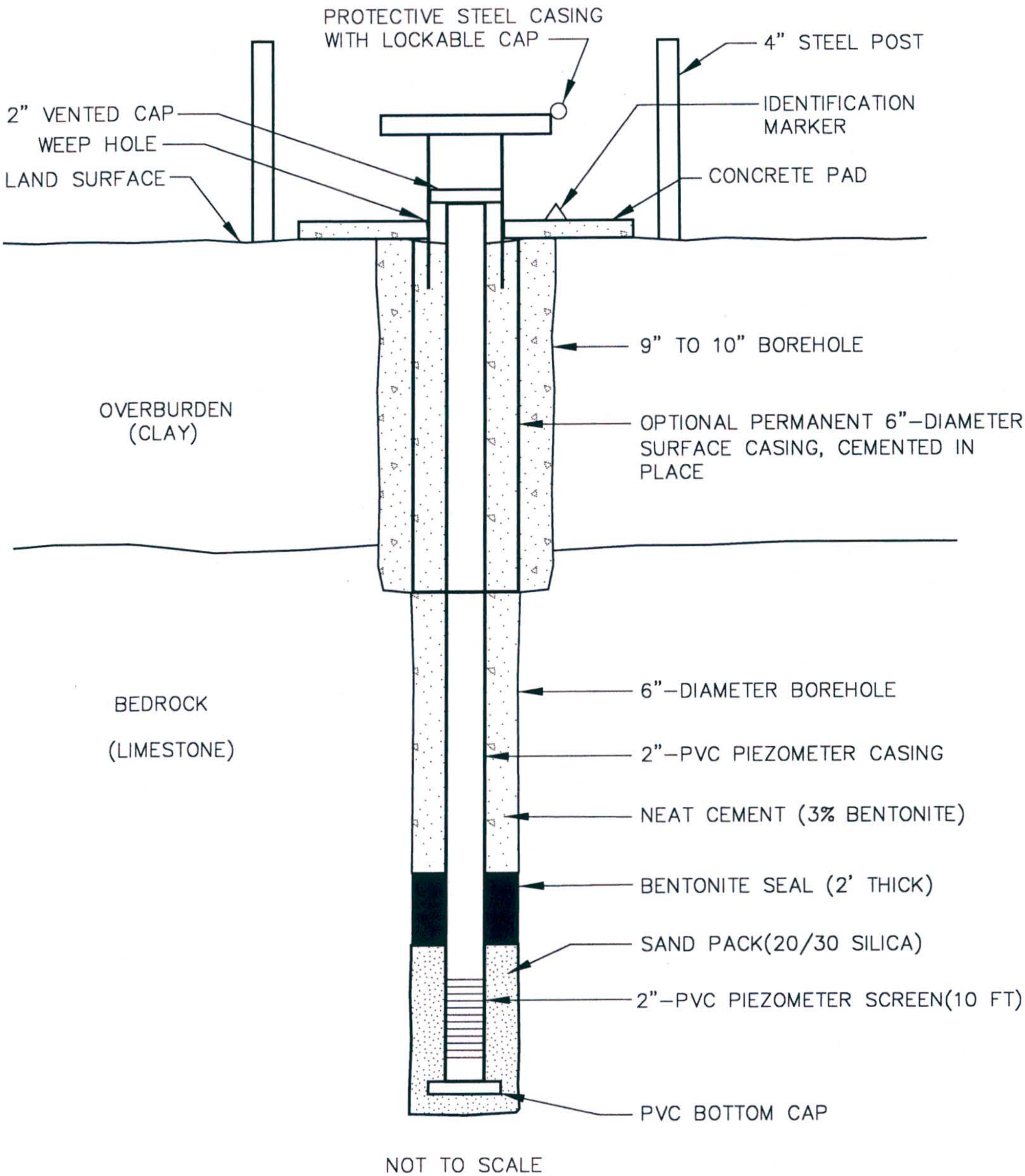
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGICAL CROSS SECTION A - A'

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 2-7

DWG DATE: 1/12/98 | PRJCT NO.: TF0318.001 | FILE NO.: SLOSS | DRAWING: SLO-S3.DWG | CHECKED: KT | APPROVED: PF | DRAFTER: BJH



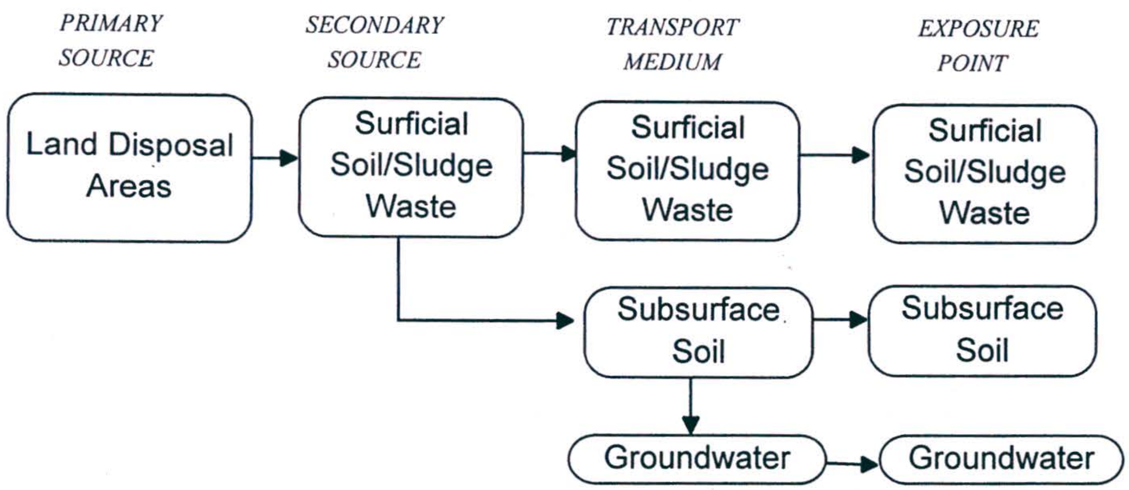
DWG DATE: 12/5/97 | PRJCT NO.: TF0320.013 | DRAWING: SLO-PIEZ.DWG | FILE NO.: SLOSS | CHECKED: JK | APPROVED: PF | DRAFTER: BJH

GERAGHTY & MILLER, INC.
Environmental Services

TYPICAL BEDROCK MONITOR WELL DESIGN

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE
3-5



RECEPTORS

Exposure Point	EXPOSURE ROUTE	HUMAN – CURRENT: SITE WORKER	HUMAN – FUTURE: SITE WORKER	HUMAN – FUTURE: CONSTRUCTION WORKER	BIOTA: TERRESTRIAL	BIOTA: AQUATIC
Surficial Soil/Sludge Waste	*Oral*	•	•	•	•	
	Dermal	•	•	•	•	
	Inhalation	•	•	•		
Subsurface Soil	*Oral*			•		
	Dermal			•		
	Inhalation			•		
Groundwater	*Oral*					
	Dermal					
	Inhalation					

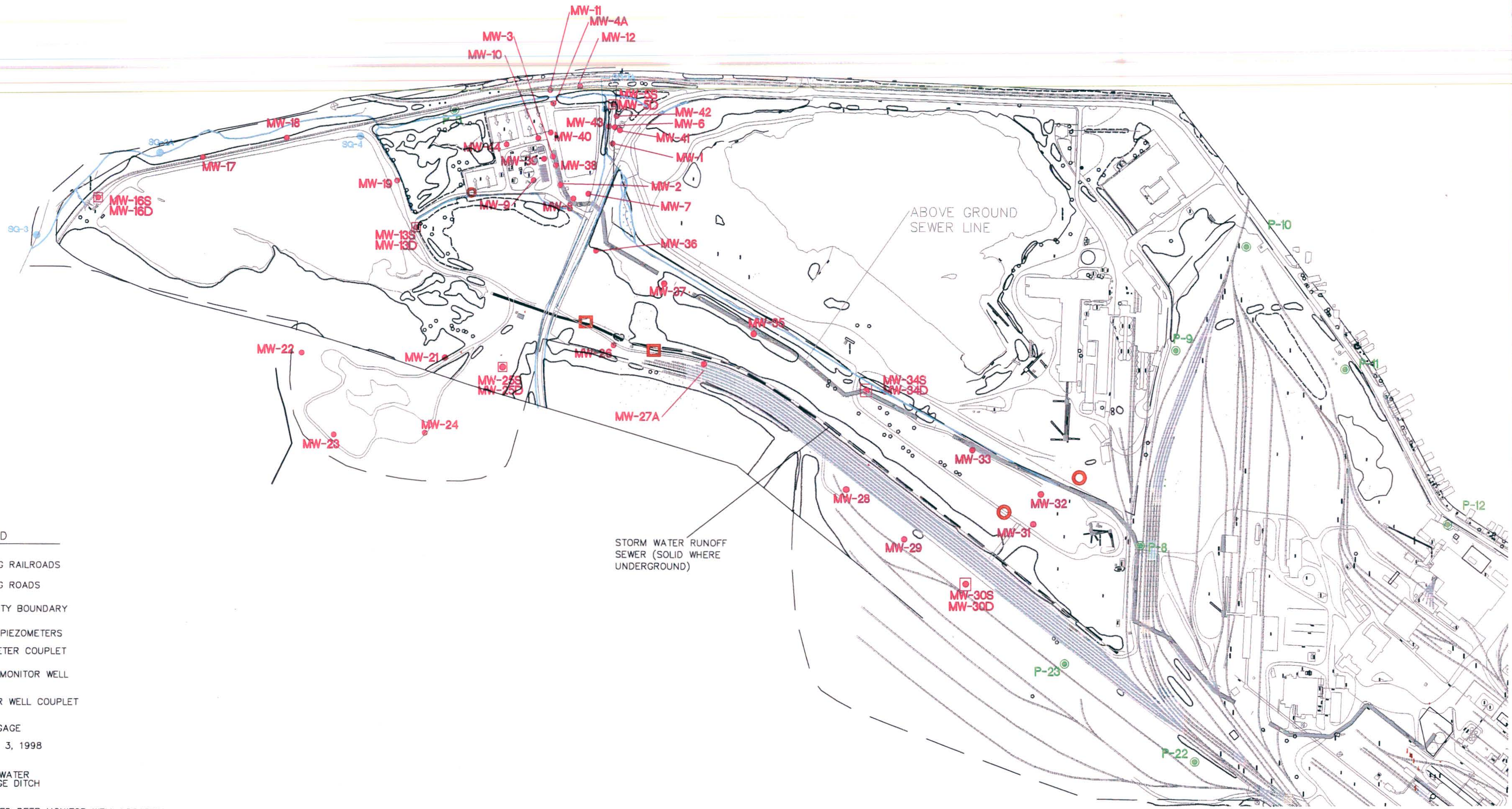
GERAGHTY & MILLER, INC.
Environment and Infrastructure
a heidemij company

CONCEPTUAL SITE MODEL FOR POTENTIAL EXPOSURE

Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Figure 5-1

g:\proj\tf320\landdisp\rpt\Csm.xls



LEGEND

	EXISTING RAILROADS
	EXISTING ROADS
	PROPERTY BOUNDARY
P-31	SINGLE PIEZOMETERS
P-1	PIEZOMETER COUPLET
MW-21	SINGLE MONITOR WELL
MW-25	MONITOR WELL COUPLET
SG-3	STAFF GAGE AUGUST 3, 1998
	STORM WATER DRAINAGE DITCH
	PROPOSED DEEP MONITOR WELL LOCATION
	PROPOSED SHALLOW MONITOR WELL LOCATION

ARCADIS GERAGHTY & MILLER
14497 North Dale Mabry Hwy., Suite 115
Tampa, Florida 33618
Tel: 813/961-1921 Fax: 813/961-2599

DATE 11/27/00	PROJECT MANAGER PF	PROJECT OFFICER PF
DRAWN BJH	LEAD DESIGN PROF. KT	CHECKED KT
CADD FILE NAME SL-LDA-RFI.DWG	PROJECT NUMBER TF000320.0016	

PROPOSED MONITOR WELL LOCATIONS
LAND DISPOSAL AREAS RFI

SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE NUMBER
6-1

TABLE 1-1
Summary of SWMUs
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU No.	Name	Description	RFA Recommendation
Land Disposal Area SWMUs			
23	Biological Sludge Disposal Area	Land Disposal Area	FA
24	Blast Furnace Emission Control Sludge Waste Pile	Land Disposal Area	FA
38	Landfill	Land Disposal Area	FA
39	Blast Furnace Emission Control Sludge Waste Pile Near Landfill	Land Disposal Area	FA
Coke Manufacturing Plant SWMUs			
1	Quench Towers and Sump	Concrete tower and sump	FA
2	Quench Tower Pump Basins	Inground concrete tank	FA
3	Old Quench Tower Settling Basins	Inground concrete tank	FA
5	Coal Tar Storage Area Drain System	Inground concrete trough	FA
6	Spill Area Around Diesel Tank	Aboveground Tank	FA
7	Coal Tar Collection Sump in No. 1 Pump House	Concrete sump	FA
8	Flushing Liquor Decanter	Aboveground tank	FA
9	Flushing Liquor Decanter Sump	Concrete sump	FA
10	Coal Tar Decanter for No. 3 and No. 4 Coke Batteries	Aboveground tank	FA
11	Coal Tar Decanter for No. 5 Coke Battery	Aboveground tank	FA
12	Coal Tar Decanter for No. 1 and No. 2 Coke Batteries	Aboveground steel tank	FA
Biological Treatment Facility (BTF) and Sewers SWMUs			
4	BTF Sewer	Inground sewer line	FA
13	BTF Equalization Basin	Surface impoundment	FA
14	BTF Neutralization Basin	Inground concrete tank	NFA
15	BTF Primary Clarifier	Inground concrete tank	NFA
16	BTF Aeration Basin	Inground concrete tank	NFA
17	BTF Secondary Clarifier	Inground concrete tank	NFA
18	BTF Thickener	Inground concrete tank	NFA
19	BTF Digester	Inground concrete tank	NFA
20	Dewatering Machine	Filter press	NFA
21	BTF Emergency Basin	Surface impoundment	FA
22	Polishing Pond	Surface impoundment	FA
25	Storm-Water Runoff Sewer	Inground sewer line	FA
37	BTF Sewer Tar Trap	Inground concrete basin	FA

TABLE 1-1
Summary of SWMUs
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU No.	Name	Description	RFA Recommendation
Chemical Manufacturing Plant SWMUs			
26	Chemical Manufacturing Plant Main Process Building Floor Drain	Tile-lined trough	FA
27	TSA 94 Building Drain Floor	Tile-lined trough	FA
28	Sulfonation Building Floor Drain	Stainless Steel trough	NFA
29	Chemical Product Tank Containment Area	Concrete containment area	FA
30	Centrifuge Wastewater Tank	Aboveground Steel Tank	NFA
31	Monohydrate Building Floor Drain and Sump	Concrete drain and sump	FA
32	BSC 94 Drum Storage Area	Plastic drums	NFA
33	BSC Plant Drum Storage Area	Plastic drums	NFA
34	BSC Wastewater Neutralization System	Concrete containment	NFA
35	Old Waste Pile at Mineral Wool Plant	Land Disposal Area	NFA
36	Maintenance Shop Used Oil Tank	Aboveground tank	FA

FA Further Action.
NFA No Further Action.

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC		950615-FW-00-SL0001(0-2)			950615-FW-00-SL0001(8-10)			950615-FW-00-SL0001(14-16)			950615-FW-00-SL0002(0-2)	
SAMPLE DATE	Ingestion		06/15/95			06/15/95			06/15/95			06/15/95	
MATRIX	Soil		SOIL			SOIL			SOIL			SOIL	
SL LOG NUMBER	Residential [1/]		T511787*1			T511787*2			T511787*3			T511787*4	
Volatile Organic Compounds (ug/kg dw):													
Methylene chloride (Dichloromethane)	85,000	<	5.8			3.6	J	<	7.2			4.3	J
Tetrachloroethene	12,000	<	5.8		<	5.8		<	7.2			0.58	J
Toluene	16,000,000		5.8	U		1.1	J		1.0	J		6.2	U
1,1,2-Trichloroethane	11,000	<	5.8		<	5.8		<	7.2			0.67	J
Trichloroethene	58,000	<	5.8		<	5.8		<	7.2		<	6.2	
Semivolatile Organics (ug/kg dw):													
Benzo(a)anthracene	870		33	J	<	430		<	500		<	410	
Benzo(b)fluoranthene	870		65	J	<	430		<	500			66	J
Benzo(k)fluoranthene	8,700	<	390		<	430		<	500		<	410	
Benzo(a)pyrene	87		40	J	<	430		<	500		<	410	
bis(2-Ethylhexyl)phthalate	46,000	<	390		<	430		<	500		<	410	
Chrysene	87,000		43	J	<	430		<	500		<	410	
Di-n-butylphthalate	7,800,000	<	390		<	430		<	500		<	410	
Di-n-octylphthalate	1,600,000	<	390		<	430		<	500		<	410	
Fluoranthene	3,100,000		58	J	<	430		<	500			61	J
Naphthalene	1,600,000		44	J	<	430		<	500			48	J
Phenanthrene	NS		30	J	<	430		<	500		<	410	
Pyrene	2,300,000		52	J	<	430		<	500		<	410	
Metals (mg/kg dw):													
Arsenic	0.43 [2/]		11			7.2			4.3			16	
Barium	5,500		44			85			100			51	
Beryllium	160		0.69			1.8			2.2			0.87	
Chromium	230 [3/]		16			25			27			39	
Copper	3,100		8.2			18			32			6.7	
Lead	400		23			8.7			9.7			20	
Nickel	1,600		4.7			22			40			5.5	
Thallium	5.5	<	1			1.3		<	1			1.1	
Zinc	23,000		67			28			71			38	
Mercury	7.8 [4/]		0.038			0.039			0.056			0.034	
Percent Solids			85 %			78 %			67 %			82 %	

Footnotes on Page 6

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC		950615-FW-00-SL0002(8-10)			950615-FW-00-SL0002(12-14)			950615-FW-00-SL0003(0-2)			950615-FW-00-SL0003(6-8)	
SAMPLE DATE	Ingestion		06/15/95			06/15/95			06/15/95			06/15/95	
MATRIX	Soil		SOIL			SOIL			SOIL			SOIL	
SL LOG NUMBER	Residential [1/]		T511787*5			T511787*6			T511787*7			T511787*8	
Volatile Organic Compounds (ug/kg dw):													
Methylene chloride (Dichloromethane)	85,000	<	6.1			5.5	J		2.8	J	<	6.6	
Tetrachloroethene	12,000	<	6.1		<	6.9		<	6.1		<	6.6	
Toluene	16,000,000		3.3	J		1.1	J		6.1	U		1.4	J
1,1,2-Trichloroethane	11,000		2.6	J		0.57	J	<	6.1			0.74	J
Trichloroethene	58,000	<	6.1		<	6.9		<	6.1		<	6.6	
Semivolatile Organics (ug/kg dw):													
Benzo(a)anthracene	870	<	460		<	480		<	410		<	460	
Benzo(b)fluoranthene	870	<	460		<	480		<	410		<	460	
Benzo(k)fluoranthene	8,700	<	460		<	480		<	410		<	460	
Benzo(a)pyrene	87	<	460		<	480		<	410		<	460	
bis(2-Ethylhexyl)phthalate	46,000	<	460		<	480			31	J	<	460	
Chrysene	87,000	<	460		<	480		<	410		<	460	
Di-n-butylphthalate	7,800,000	<	460		<	480		<	410		<	460	
Di-n-octylphthalate	1,600,000	<	460		<	480		<	410		<	460	
Fluoranthene	3,100,000	<	460		<	480		<	410		<	460	
Naphthalene	1,600,000	<	460		<	480		<	410		<	460	
Phenanthrene	NS	<	460		<	480		<	410		<	460	
Pyrene	2,300,000	<	460		<	480		<	410		<	460	
Metals (mg/kg dw):													
Arsenic	0.43 [2/]		$\boxed{6.6}$			$\boxed{5.7}$			$\boxed{14}$			$\boxed{9.7}$	
Barium	5,500		120			200			53			100	
Beryllium	160		1.7			2.5			0.51			1.8	
Chromium	230 [3/]		32			43			20			33	
Copper	3,100		20			29			5.0			21	
Lead	400		9.3			10			11			17	
Nickel	1,600		36			47			5.5			25	
Thallium	5.5	<	1			1.1		<	1		<	1	
Zinc	23,000		52			68			16			29	
Mercury	7.8 [4/]		0.049			0.065			0.055			0.035	
Percent Solids			72 %			69 %			82 %			73 %	

Footnotes on Page 6

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID SAMPLE DATE MATRIX SL LOG NUMBER	USEPA RBC Ingestion Soil Residential [1/]	950615-FW-00-SL0003(10-12) 06/15/95 SOIL T511787*9	950615-FW-00-SL9003 06/15/95 SOIL T511787*10	950629-FW-00-SL0004(0-2) 06/29/95 SOIL T511949*4	950629-FW-00-SL0004(16-18) 06/29/95 SOIL T511949*5
Volatile Organic Compounds (ug/kg dw):					
Methylene chloride (Dichloromethane)	85,000	< 7.4	< 6.1	< 5.7	6.0
Tetrachloroethene	12,000	< 7.4	< 6.1	< 5.7	< 5.6
Toluene	16,000,000	2 J	6.1 U	< 5.7	< 5.6
1,1,2-Trichloroethane	11,000	0.86 J	< 6.1	< 5.7	< 5.6
Trichloroethene	58,000	< 7.4	< 6.1	< 5.7	< 5.6
Semivolatile Organics (ug/kg dw):					
Benzo(a)anthracene	870	< 490	< 410	< 400	< 380
Benzo(b)fluoranthene	870	< 490	< 410	< 400	< 380
Benzo(k)fluoranthene	8,700	< 490	< 410	< 400	< 380
Benzo(a)pyrene	87	< 490	< 410	< 400	< 380
bis(2-Ethylhexyl)phthalate	46,000	< 490	< 410	< 400	< 380
Chrysene	87,000	< 490	< 410	< 400	< 380
Di-n-butylphthalate	7,800,000	< 490	< 410	< 400	< 380
Di-n-octylphthalate	1,600,000	< 490	16 J	32.0 J	< 380
Fluoranthene	3,100,000	< 490	< 410	< 400	< 380
Naphthalene	1,600,000	< 490	< 410	< 400	< 380
Phenanthrene	NS	< 490	< 410	< 400	< 380
Pyrene	2,300,000	< 490	< 410	< 400	< 380
Metals (mg/kg dw):					
Arsenic	0.43 [2/]	5.1	21	13	1.9
Barium	5,500	95	50	28	21
Beryllium	160	2.6	0.60	0.44	0.97
Chromium	230 [3/]	27	46	22	8.6
Copper	3,100	22	5.9	8.1	7.8
Lead	400	9.5	14	5.0	7.5
Nickel	1,600	37	9.4	10	15
Thallium	5.5	< 1	< 1	< 1.0	< 1.0
Zinc	23,000	49	27	25	14
Mercury	7.8 [4/]	0.15	0.038	< 0.030	< 0.030
Percent Solids		68 %	82 %	NA	NA

Footnotes on Page 6

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID / SAMPLE DATE / MATRIX / SL LOG NUMBER	USEPA RBC Ingestion Soil Residential [1/]		950629-FW-00-SL0004(36-38) 06/29/95 WATER T511949*1			950719-FW-00-SL0005 (0-2) 07/19/95 SOIL T512142*3			950719-FW-00-SL0005 (2-4) 07/19/95 SOIL T512142*4			950719-FW-00-SL0005 (4-6) 07/19/95 SOIL T512142*5	
Volatile Organic Compounds (ug/kg dw):													
Methylene chloride (Dichloromethane)	85,000	<	5.8		<	5.6		<	5.2		<	5.8	
Tetrachloroethene	12,000	<	5.8			3.2	J		5.2	U		5.8	U
Toluene	16,000,000	<	5.8		<	5.6		<	5.2		<	5.8	
1,1,2-Trichloroethane	11,000	<	5.8		<	5.6		<	5.2		<	5.8	
Trichloroethene	58,000	<	5.8			12			2.6	J		8.0	
Semivolatile Organics (ug/kg dw):													
Benzo(a)anthracene	870	<	400		<	360		<	360		<	350	
Benzo(b)fluoranthene	870	<	400		<	360		<	360		<	350	
Benzo(k)fluoranthene	8,700	<	400		<	360		<	360		<	350	
Benzo(a)pyrene	87	<	400		<	360		<	360		<	350	
bis(2-Ethylhexyl)phthalate	46,000	<	400		<	360		<	360		<	350	
Chrysene	87,000	<	400		<	360		<	360		<	350	
Di-n-butylphthalate	7,800,000	<	400		<	360			72	J	<	350	
Di-n-octylphthalate	1,600,000	<	400		<	360			18	J	<	350	
Fluoranthene	3,100,000	<	400		<	360		<	360		<	350	
Naphthalene	1,600,000	<	400		<	360		<	360		<	350	
Phenanthrene	NS	<	400		<	360		<	360		<	350	
Pyrene	2,300,000	<	400		<	360		<	360		<	350	
Metals (mg/kg dw):													
Arsenic	0.43 [2/]		$\boxed{3.8}$			$\boxed{6.0}$			$\boxed{3.1}$			$\boxed{5.5}$	
Barium	5,500		43			58			28			15	
Beryllium	160		1.4			0.52			0.53		<	0.40	
Chromium	230 [3/]		17			37			32			18	
Copper	3,100		10			12			11			6.1	
Lead	400		9.7			15			11			8.0	
Nickel	1,600		28			4.7		<	4.0		<	4.0	
Thallium	5.5	<	1.0		<	1.0		<	1.0		<	1.0	
Zinc	23,000		70			29			40			11	
Mercury	7.8 [4/]	<	0.030			0.035		<	0.030		<	0.030	
Percent Solids			NA			92 %			92 %			94 %	

Footnotes on Page 6

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC		950719-FW-00-SL0006 (0-2)			950719-FW-00-SL0006 (10-12)			950719-FW-00-SL0006 (20-22)	
SAMPLE DATE	Ingestion		07/19/95			07/19/95			07/19/95	
MATRIX	Soil		SOIL			SOIL			SOIL	
SL LOG NUMBER	Residential [1/]		T512142*6			T512142*7			T512142*8	
Volatile Organic Compounds (ug/kg dw):										
Methylene chloride (Dichloromethane)	85,000		1.9	J		1.4	J	<	6.1	
Tetrachloroethene	12,000		20		<	5.7		<	6.1	
Toluene	16,000,000		7.4		<	5.7		<	6.1	
1,1,2-Trichloroethane	11,000	<	6.1		<	5.7		<	6.1	
Trichloroethene	58,000		82		<	5.7			6.1	U
Semivolatile Organics (ug/kg dw):										
Benzo(a)anthracene	870	<	370		<	390		<	370	
Benzo(b)fluoranthene	870	<	370		<	390		<	370	
Benzo(k)fluoranthene	8,700	<	370		<	390		<	370	
Benzo(a)pyrene	87	<	370		<	390		<	370	
bis(2-Ethylhexyl)phthalate	46,000	<	370		<	390		<	370	
Chrysene	87,000	<	370		<	390		<	370	
Di-n-butylphthalate	7,800,000	<	370		<	390		<	370	
Di-n-octylphthalate	1,600,000		38	J		180	J		76	J
Fluoranthene	3,100,000	<	370		<	370		<	370	
Naphthalene	1,600,000	<	370		<	390		<	370	
Phenanthrene	NS	<	370		<	390		<	370	
Pyrene	2,300,000	<	370		<	390		<	370	
Metals (mg/kg dw):										
Arsenic	0.43 [2/]		7.6			7.9			14	
Barium	5,500		72			45			14	
Beryllium	160		0.58		<	0.40		<	0.40	
Chromium	230 [3/]		30			36			13	
Copper	3,100		9.9			10			9.0	
Lead	400		10			14			11	
Nickel	1,600		15			7.8		<	4.0	
Thallium	5.5	<	1.0		<	1.0		<	1.0	
Zinc	23,000		45			21			8.6	
Mercury	7.8 [4/]		0.040		<	0.030		<	0.030	
Percent Solids			89 %			86 %			90 %	

Footnotes on Page 6

TABLE 2-1
Summary of Constituents Detected in Background Soil Samples
Land Disposal Areas RFI
Sloss Industries Corporation

FOOTNOTES:

NA Not Available.

NS No Standard.

J Positive results has been classified as qualitative during data validation or values are greater than the Method Detection Limit (MDL) but less than the Contract Required Quantitation Limit (CRQL) and Contract Required Detection Limit (CRDL). A B after the J (JB) indicates analyte was in a laboratory blank.

U Classified as nondetected.

1/ Source: USEPA Region III Risk-Based Concentrations (RBC), April 13, 2000.

2/ RBC for arsenic as a carcinogen.

3/ Chromium VI.

4/ RBC for methylmercury.

☐ Concentration Exceeds USEPA Residential RBC.

TABLE 2-2
Summary of Monitor Well and Piezometer
Construction Details and August 17, 1997 Groundwater Elevations
Land Disposal Areas RFI
Sloss Industries Corporation

Monitor Well/ Piezometer Identification	Previous Identification	SWMU Area	SWMU	Date Completed	Top of Casing (ft amsl)	Surface Elevation (ft amsl)	Monitor Well/ Piezometer Depth (ft bls)	Screen Interval (ft bls)	Depth to Water 8/17/97 (ft btoc)	Water Table Elevation 8/17/97 (ft amsl)
P-01D		FW		7/13/95	523.02	520.57	44.5	34.5 - 44.5	17	506.02
P-01S		FW		7/25/95	522.76	520.26	21	11 - 21	16.6	506.16
P-02		FW		7/18/95	531.53	528.5	35.5	25.5 - 35.5	13.92	517.61
P-03		FW		7/21/95	532.98	530.17	32	22 - 32	10.95	522.03
P-04		FW		7/26/95	532.4	529.48	37.5	27.5 - 37.5	11.52	520.88
P-08		FW		7/11/95	568.46	566.48	33	23 - 33	7.57	560.89
P-09		FW		7/6/95	568.22	565.64	160.5	150.5 - 160.5	162.54	405.68
P-10		FW		7/6/95	569.68	567.8	32.5	22.5 - 32.5	12.5	557.18
P-11		FW		7/8/95	569.95	567.56	27	17 - 27	6.44	563.51
P-12		FW		7/8/95	579.42	576.79	26.5	16.5 - 26.5	6.14	573.28
P-13D		FW		7/15/96	581.37	578.53	169.5	159.5 - 169.5	114.83	466.54
P-13S		FW		7/26/95	581.41	578.48	26	16 - 26	9.68	571.73
P-14		FW		7/13/96	583.37	580.82	75.5	65.5 - 75.5	9.11	574.26
P-15		FW		7/12/95	581.69	582.03	25.5	15.5 - 25.5	5.79	575.9
P-16a		FW		7/10/95	585.18	582.26	21.5	11.5 - 21.5	5.52	579.66
P-17		FW		6/29/95	586.16	583.74	115.5	105.5 - 115.5	5.06	581.1
P-18		FW		6/29/95	594.06	591.91	72.5	62.5 - 72.5	11.05	583.01
P-19D		FW		6/30/95	591.19	589.11	57.5	47.5 - 57.5	4.29	586.9
P-19S		FW		6/27/95	591.41	589.33	27.5	17.5 - 27.5	4.51	586.9
P-20		FW		7/31/95	585.2	582.57	198.3	188.3 - 198.3	82.15	503.05
P-21		FW		6/23/95	575.75	573.59	165.5	155.5 - 165.5	121.41	454.34
P-22		FW		6/17/95	570.82	568.44	48.5	38.5 - 48.5	10.56	560.26
P-23		FW		6/17/95	564.67	562.49	48.5	38.5 - 48.5	17.02	547.65
P-32		FW		8/4/95	579.71	576.89	27	17 - 27	5.62	574.09
MW-05		FW		NA	532.05	529.89	18	8 - 18	NM	NM

TABLE 2-2
Summary of Monitor Well and Piezometer
Construction Details and August 17, 1997 Groundwater Elevations
Land Disposal Areas RFI
Sloss Industries Corporation

Monitor Well/ Piezometer Identification	Previous Identification	SWMU Area	SWMU	Date Completed	Top of Casing (ft amsl)	Surface Elevation (ft amsl)	Monitor Well/ Piezometer Depth (ft bls)	Screen Interval (ft bls)	Depth to Water 8/17/97 (ft btoc)	Water Table Elevation 8/17/97 (ft amsl)
MW-21		LD	23	8/9/97	558.85	556.58	39	29 - 39	15.3	543.55
MW-22	P-31	LD	23	7/20/95	628.86	625.7	118.5	108.5 - 118.5	93.62	535.24
MW-23	P-30	LD	23	7/27/95	635.88	632.94	78.5	68.5 - 78.5	31.98	603.9
MW-24	P-29	LD	23	7/26/95	594.99	591.81	73.3	63.3 - 73.3	12.97	582.02
MW-25D	P-28D	LD	23	7/26/95	559.63	556.87	66.3	56.3 - 66.3	17.17	542.46
MW-25S	P-28S	LD	23	7/20/95	559.67	556.76	45.5	35.5 - 45.5	17.87	541.8
MW-26	P-27	LD	38	6/20/95	549.58	547.41	140.5	130.5 - 140.5	85.48	464.1
MW-27	P-26	LD	38	6/16/95	554.97	552.15	37	27 - 37	16.09	538.88
MW-28	P-25	LD	38	6/15/95	558.32	556.44	58	48 - 58	16.31	542.01
MW-29		LD	38	8/12/97	563.89	561.86	36	26 - 36	20.55	543.34
MW-30D	P-24D	LD	38	6/17/95	564.43	562.26	58.5	48.5 - 58.5	20.67	543.76
MW-30S	P-24S	LD	38	6/20/95	564.68	562.21	34.5	24.5 - 34.5	21.17	543.51
MW-31		LD	39	8/13/97	571.52	569.46	46.5	36.5 - 46.5	20.74	550.78
MW-32	P-07	LD	39	6/21/95	569.43	567.24	47	37 - 47	16.84	552.59
MW-33		LD	39	8/11/97	556.73	554.46	39	29 - 39	8.18	548.55
MW-34D	P-06D	LD	39	6/21/95	546.1	544	178	168 - 178	5.69	540.41
MW-34S	P-06S	LD	39	6/26/95	545.98	543.84	34	24 - 34	6.37	539.61
MW-35		LD	39	8/14/97	542.46	540.12	29.5	19.5 - 29.5	26.33	516.13
MW-36 1/	P-05	LD	39	6/23/95	532.43	530.34	136.5	126.5 - 136.5	-2.71	535.14
MW-37		LD	38	8/11/97	537.44	535.36	30	20 - 30	3.84	533.6

ft amsl	Feet above mean sea level.
ft bls	Feet below land surface.
ft btoc	Feet below top of casing.
NM	Not Measured
FW	Facility-Wide
LD	Land Disposal Areas
1/	Flowing Well

TABLE 2-3
Summary of In-Situ Permeability Testing for Facility-Wide and Land Disposal Areas Investigations
Sloss Industries Corporation

Well	K (cm/sec) Slug In	K (cm/sec) Slug Out	i (ft/ft)	n	v (ft/min) Slug In	v (ft/min) Slug Out	v (ft/year) Slug In	v (ft/year) Slug Out
Conasauga Limestone								
P-2	8 E-04	4 E-04	0.025	0.20	2 E-04	1 E-04	100	60
P-3	2 E-03	1 E-03	0.025	0.20	4 E-04	3 E-04	200	200
P-4	1 E-06	4 E-08	0.025	0.01	6 E-06	2 E-07	3	0.1
P-8	3 E-03	4 E-03	0.025	0.20	8 E-04	1 E-03	400	600
P-10	3 E-03	3 E-03	0.025	0.20	7 E-04	7 E-04	400	300
P-11	2 E-04	2 E-04	0.025	0.20	6 E-05	5 E-05	30	20
P-12	4 E-05	8 E-07	0.010	0.01	8 E-05	2 E-06	40	0.9
P-12 DUP	7 E-07	7 E-08	0.010	0.01	1 E-06	1 E-07	0.7	0.07
P-13S	7 E-04	7 E-04	0.010	0.20	7 E-05	7 E-05	40	30
P-14	1 E-04	1 E-04	0.010	0.20	1 E-05	1 E-05	8	7
P-15	4 E-07	5 E-07	0.010	0.01	8 E-07	1 E-06	0.4	0.5
P-16	7 E-04	6 E-04	0.010	0.20	7 E-05	6 E-05	40	30
P-17	4 E-07	7 E-07	0.010	0.01	7 E-07	1 E-06	0.4	0.7
P-18	5 E-04	6 E-04	0.010	0.20	5 E-05	6 E-05	20	30
P-19S	5 E-03	3 E-03	0.010	0.20	5 E-04	3 E-04	300	200
P-19D	6 E-03	7 E-03	0.010	0.20	5 E-04	7 E-04	300	400
P-20	7 E-06	2 E-04	0.010	0.01	1 E-05	4 E-04	8	200
P-22	8 E-04	7 E-04	0.025	0.20	2 E-04	2 E-04	100	90
P-23	8 E-06	4 E-06	0.025	0.01	4 E-05	2 E-05	20	10
P-32	3 E-04	3 E-04	0.025	0.20	9 E-05	7 E-05	40	30
MW-5	1 E-03	9 E-03	0.025	0.20	3 E-04	2 E-03	200	1000
MW-21	2 E-05	3 E-05	0.100	0.20	2 E-05	3 E-05	10	10
MW-25S	2 E-04	1 E-04	0.100	0.20	2 E-04	1 E-04	100	70
MW-25D	1 E-05	6 E-06	0.100	0.20	1 E-05	6 E-06	8	3
MW-27	7 E-03	6 E-03	0.025	0.20	2 E-03	2 E-03	900	800
MW-28	1 E-03	1 E-03	0.025	0.20	3 E-04	3 E-04	100	100
MW-29	7 E-02	7 E-02	0.025	0.20	2 E-02	2 E-02	9000	9000
MW-30S	1 E-02	1 E-02	0.025	0.20	2 E-03	2 E-03	1000	1000
MW-30D	5 E-04	6 E-04	0.025	0.20	1 E-04	1 E-04	60	80
MW-31	2 E-04	1 E-04	0.025	0.20	4 E-05	3 E-05	20	20
MW-32	2 E-04	2 E-04	0.025	0.20	5 E-05	4 E-05	30	20
MW-33	2 E-04	2 E-04	0.025	0.20	5 E-05	5 E-05	30	20
MW-33 DUP	1 E-04	1 E-03	0.025	0.20	3 E-05	3 E-04	20	200
MW-34S	2 E-03	2 E-03	0.025	0.20	4 E-04	4 E-04	200	200
MW-34D	1 E-07	2 E-07	0.025	0.01	5 E-07	1 E-06	0.3	0.6
MW-35	1 E-07	4 E-08	0.025	0.01	5 E-07	2 E-07	0.3	0.1
MW-36	1 E-03	1 E-03	0.025	0.20	3 E-04	4 E-04	200	200
MW-37	2 E-03	2 E-03	0.025	0.20	6 E-04	5 E-04	300	300
Minimum	1 E-07	4 E-08					0.3	0.07
Maximum	7 E-02	7 E-02					9000	9000
Sand Mountain								
P-1S	1 E-03	1 E-03	0.025	0.20	3 E-04	3 E-04	200	100
P-1D	7 E-03	5 E-03	0.025	0.20	2 E-03	1 E-03	900	600
MW-22	3 E-03	2 E-03	0.100	0.20	3 E-03	2 E-03	1000	1000
MW-23	9 E-05	6 E-05	0.100	0.20	9 E-05	6 E-05	50	30
MW-24	5 E-05	2 E-05	0.100	0.20	5 E-05	2 E-05	20	10
Minimum	5 E-05	2 E-05					20	10
Maximum	7 E-03	5 E-03					1000	1000

Footnotes:

cm/sec - Centimeters per second.
ft/ft - Feet per feet.
ft/min - Feet per minute.
ft/year -Feet per year.
K - Hydraulic permeabity.
i - Hydraulic gradient.
n - Porosity (void volume / total volume).
v - Velocity = K i / n.

g:\proj\tf320\landdisp\rpt\table\Ksummary

TABLE 3-1
Summary of Surficial Soil Samples Collected
at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU	Location	Sample ID	Sample Interval (ft bls)	Date Sampled
SWMU24	24-SL0002	970618-LD-24-SL0002	0-1	6/18/97
	24-SL0003	970617-LD-24-SL0003	0-1	6/17/97
	24-SL0004	970617-LD-24-SL0004	0-1	6/17/97
	24-SL0005	970617-LD-24-SL0005	0-1	6/17/97
	24-SL0006	970617-LD-24-SL0006	0-1	6/17/97
	24-SL0006	970617-LD-24-SL9001	0-1	6/17/97
	24-SL0007	970617-LD-24-SL0007	0-1	6/17/97
	24-SL0008	970618-LD-24-SL0008	0-1	6/18/97
	24-SL0009	970618-LD-24-SL0009	0-1	6/18/97
	24-SL0010	970618-LD-24-SL0010	0-1	6/18/97
	24-SL0011	970618-LD-24-SL0011	0-1	6/18/97
	24-SL0012	970618-LD-24-SL0012	0-1	6/18/97
	24-SL0013	970618-LD-24-SL0013	0-1	6/18/97
	24-SL0014	970618-LD-24-SL0014	0-1	6/18/97
	24-SL0015	970618-LD-24-SL0015	0-1	6/18/97
	24-SL0016	970618-LD-24-SL0016	0-1	6/18/97

Note: Sample 970617-LD-24-SL9001is the duplicate of sample 970617-LD-24-SL0006.
The ground was cleared of sludge before collecting the soil sample.
ft bls - feet below land surface.

TABLE 3-2
Summary of Sludge Samples Collected
at SWMUs 23, 24, and 39 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU	Location	Sample ID	Date Sampled
SWMU 23	23-SM0001	970619-LD-23-SM0001	6/19/97
	23-SM0001	970619-LD-23-SM9001	6/19/97
	23-SM0002	970619-LD-23-SM0002	6/19/97
	23-SM0003	970619-LD-23-SM0003	6/19/97
	23-SM0004	970619-LD-23-SM0004	6/19/97
SWMU 24	24-SM0001	970619-LD-24-SM0001	6/19/97
	24-SM0001	970619-LD-24-SM9001	6/19/97
	24-SM0002	970619-LD-24-SM0002	6/19/97
	24-SM0003	970619-LD-24-SM0003	6/19/97
	24-SM0004	970619-LD-24-SM0004	6/19/97
SWMU 39	39-SM0002	970616-LD-39-SM0002	6/16/97
	39-SM0005	970619-LD-39-SM0005	6/19/97
	39-SM0006	970619-LD-39-SM0006	6/19/97
	39-SM0003	970616-LD-39-SM0003	6/16/97
	39-SM0003	970616-LD-39-SM9001	6/16/97

NOTE: Sample 970619-LD-23-SM9001 is the duplicate of 970619-LD-23-SM0001; sample 970619-LD-24-SM9001 is the duplicate of 970619-LD-24-SM0001; sample 970616-LD-39-SM9001 is the duplicate of 970616-LD-39-SM0003.

TABLE 3-3
Summary of Subsurface Soil Samples
Collected at SWMUs 23, 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU	Location Name	Sample ID	Sample Interval (ft bls)	Date Sampled	Surface Elevation (ft amsl)	Sample Elevation (ft amsl)	Comments
SWMU 23	*MW-21*	970806-LD-23-SL0021(14-16)	14 - 16	8/6/97	556.58	542.58 - 540.58	
		970806-LD-23-SL0021(20-22)	20 - 22	8/6/97	556.58	536.58 - 534.58	
		970806-LD-23-SL9021(duplicate)	20 - 22	8/6/97	556.58	536.58 - 534.58	
	23-SB*MW22*	970806-LD-23-SL0022(0-2)	0-2	8/6/97	625.7	625.7 - 623.7	Soil boring located 3 ft S of MW-22.
	23-SB*MW23*	970806-LD-23-SL0023(12-14)	12-14	8/6/97	632.94	620.94 - 618.94	Soil boring located 3 ft S of MW-23.
		970806-LD-23-SL0023(24-26)	24-26	8/6/97	632.94	608.94 - 606.94	
	23-SB*MW24*	970805-LD-23-SL0024(7-9)	7-9	8/5/97	591.81	584.81 - 582.81	Soil boring located 5 ft W of MW-24.
		970805-LD-23-SL0024(14-16)	14-16	8/5/97	591.81	577.81 - 575.81	
	23-SB*MW25*	970805-LD-23-SL0025(19-21)	19-21	8/5/97	556.76	537.76 - 535.76	Soil boring located between MW-25S and MW-25D.
SWMU 38	38-SB*MW26*	970804-LD-38-SL0026(10-12)	10-12	8/4/97	547.41	537.41 - 535.41	Soil boring located 3 ft S of MW-26.
		970804-LD-38-SL9026 (duplicate)	10-12	8/4/97	547.41	537.41 - 535.41	
		970804-LD-38-SL0026(18-20)	18-20	8/4/97	547.41	529.41 - 527.41	
	38-SB*MW27*	970805-LD-38-SL0027(11-13)	11-13	8/5/97	552.15	541.15 - 539.15	
		970805-LD-38-SL0027(22-24)	22-24	8/5/97	552.15	530.15 - 528.15	Soil boring located 3 ft SE of MW-27.
		970808-LD-38-SL0027(22-24) [1/]	22-24	8/8/97	552.15	530.15 - 528.15	
	38-SB*MW28*	970807-LD-38-SL0028(8-10)	8-10	8/7/97	556.44	548.44 - 546.44	Soil boring located 5 ft SE of MW-28.
		970807-LD-38-SL0028(13-15)	13-15	8/7/97	556.44	543.44 - 541.44	

TABLE 3-3
Summary of Subsurface Soil Samples
Collected at SWMUs 23, 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU	Location Name	Sample ID	Sample Interval (ft bls)	Date Sampled	Surface Elevation (ft amsl)	Sample Elevation (ft amsl)	Comments
SWMU 38	*MW-29*	970807-LD-38-SL0029(15-17)	15 - 17	8/7/97	561.86	546.86 - 544.86	
		970807-LD-38-SL0029(19-21)	19 - 21	8/7/97	561.86	542.86 - 540.86	
	38-SB*MW30*	970807-LD-38-SL0030(9-11)	9-11	8/7/97	562.21	553.21 - 551.21	Soil boring located between MW-30S and MW-30D
		970807-LD-38-SL0030(17-19)	17-19	8/7/97	562.21	545.21 - 543.21	
	MW-37	970808-LD-38-SL0037(4-6)	4 - 6	8/8/97	535.36	531.36 - 529.36	
		970808-LD-38-SL0037(8-10)	8 - 10	8/8/97	535.36	527.36 - 525.36	
SWMU 39	*MW-31*						Samples were not collected since soil was not present.
	39-SB*MW32*						Samples were not collected since soil was not present.
	MW-33	970808-LD-39-SL0033(11-13)	11 - 13	8/8/97	554.46	543.46 - 541.46	
	39-SB*MW34*	970805-LD-39-SL0034(10-12)	10-12	8/5/97	543.84	533.84 - 531.84	Soil boring located between MW-34S and MW-34D
		970808-LD-39-SL0034(10-12) [1/]	10-12	8/8/97	543.84	533.84 - 531.84	
	MW-35	970808-LD-39-SL0035(10-12)	10 - 12	8/8/97	540.12	530.12 - 528.12	
	39-SB*MW36*	970804-LD-39-SL0036(5-7)	5-7	8/4/97	530.34	525.34 - 523.34	Soil boring located 5 ft S of MW-36.
		970804-LD-39-SL9036 (duplicate)	5-7	8/4/97	530.34	525.34 - 523.34	
		970804-LD-39-SL0036(10-12)	10-12	8/4/97	530.34	520.34 - 518.34	

ft bls - Feet below land surface.
ft amsl - Feet above mean sea level.
[1/] VOC sample was recollected because samples were broken during shipment.

TABLE 3-4
Results of Field Analyses for Groundwater Samples Collected in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

Location	Sample ID	Date Collected	pH (std units)	Temperature (°C)	Conductivity (umhos/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Appearance
MW-21	970818-LD-23-GW0021	8/18/97	7.30	25	1,320	7.1	28.9	sl turbid
MW-22	970818-LD-23-GW0022	8/18/97	6.86	21	530	2.4	10.10	Clear
MW-23	970818-LD-23-GW0023	8/18/97	5.78	23	170	2.4	27	Sl turbid
MW-24	970818-LD-23-GW0024	8/18/97	5.91	21	290	2.3	>200	Turbid
MW-25D	970819-LD-23-GW0025D	8/19/97	10.42	24	1,000	2.1	>200	Clear
MW-25S	970819-LD-23-GW0025S	8/19/97	7.44	22	780	1.5	2.5	Clear
MW-26	970821-LD-38-GW0026	8/21/97	7.83	20	2,850	1.3	>200	Sheen
MW-27	970819-LD-38-GW0027	8/19/97	6.56	20	840	1.8	1.97	Clear
MW-28	970819-LD-38-GW0028	8/19/97	7.23	23	610	1.9	5.1	Clear
MW-29	970819-LD-38-GW0029	8/19/97	7.34	24	630	1.1	3.6	Clear
MW-30D	970821-LD-38-GW0030D	8/21/97	7.08	21	550	2.1	6.2	Clear
MW-30S	970821-LD-38-GW0030S	8/21/97	6.64	22	510	4.4	10.1	Clear
MW-31	970821-LD-39-GW0031	8/21/97	6.64	23	430	1.9	136.4	Sl turbid
MW-32	970821-LD-39-GW0032	8/21/97	6.63	24	450	3.7	9.2	Clear
MW-33	970820-LD-39-GW0033	8/20/97	6.40	22	1,140	2.8	0.8	Clear
MW-34S	970820-LD-39-GW0034S	8/20/97	6.55	21	1,490	1.3	8.85	Clear
MW-34D	970821-LD-39-GW0034D	8/21/97	8.47	23	1,160	2.2	>200	Sl turbid
MW-35	970821-LD-39-GW0035	8/21/97	7.47	22	1,690	6.0	5.7	Clear
MW-36	970821-LD-39-GW0036	8/21/97	9.16	22	1,010	1.2	2.4	Clear
MW-37	970821-LD-38-GW0037	8/21/97	6.97	26	510	1.5	4.7	Clear

std units	Standard Units
°C	Degrees Centigrade
umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter
NTU	Nephlemetric Turbidity Units

TABLE 4-1
Summary of Site Background Soil Concentration Ranges
and USEPA Risk Based Concentrations
Land Disposal Areas RFI
Sloss Industries Corporation

CHEMICAL	BACKGROUND CONCENTRATION RANGE	USEPA RBC SOIL INGESTION-RESIDENTIAL 1/	USEPA RBC SOIL INGESTION-INDUSTRIAL 1/
Volatile Organic Compounds (ug/kg):			
Acetone	ND	7,800,000	200,000,000
Toluene	1.0-7.4	16,000,000	410,000,000
Semivolatile Organic Compounds (ug/kg):			
* Acenaphthene	ND	4,700,000	120,000,000
* Acenaphthylene	ND	NS	NS
* Anthracene	ND	23,000,000	610,000,000
* Benzo(a)anthracene	33	870	7,800
* Benzo(a)pyrene	40	87	780
* Benzo(b)fluoranthene	65-66	870	7,800
* Benzo(g,h,i)perylene	ND	NS	NS
* Benzo(k)fluoranthene	ND	8,700	78,000
* Chrysene	43	87,000	780,000
* Dibenzo(a,h)anthracene	ND	87	780
* Fluoranthene	58-61	3,100,000	82,000,000
* Fluorene	ND	3,100,000	82,000,000
* Indeno(1,2,3-cd)pyrene	ND	870	7,800
* Phenanthrene	30	NS	NS
* Naphthalene	44-48	1,600,000	41,000,000
* Pyrene	52	2,300,000	61,000,000
Metals (mg/kg):			
Antimony, Total	ND	31	820
Arsenic, Total	1.9-21	0.43 2/	3.8 2/
Barium, Total	14-200	5,500	140,000
Beryllium, Total	0.44-2.6	160	4100
Cadmium, Total	ND	39	1,000
Chromium, Total	8.6-46	230 3/	6100 3/
Copper, Total	5.0-32	3,100	82,000
Lead, Total	5.0-23	400	NS
Mercury, Total	0.034-0.15	7.8 4/	200 4/
Nickel, Total	4.7-47	1,600	41,000
Silver, Total	ND	390	10,000
Zinc, Total	8.6-71	23,000	610,000
Cyanide, Total (mg/kg):	ND	1,600	41,000

ND - Not Detected. This constituent was not detected in site background soil samples.
NS - No Standard.
1/ Source: EPA Region III Risk-Based Concentrations (RBCs), April 13, 2000
2/ RBC for arsenic as a carcinogen RBC.
3/ Chromium VI RBC.
4/ RBC for methylmercury.
* Polycyclic aromatic hydrocarbon (PAH).

TABLE 4-2
Summary of In-Situ Permeability Testing for Land Disposal Area SWMUs
Land Disposal Areas RFI
Sloss Industries Corporation

Well	K (cm/sec) Slug In	K (cm/sec) Slug Out	i (ft/ft)	n	v (ft/min) Slug In	v (ft/min) Slug Out	v (ft/year) Slug In	v (ft/year) Slug Out
SWMU 23								
MW-21	2 E-05	3 E-05	0.100	0.20	2 E-05	3 E-05	10	10
MW-22	3 E-03	2 E-03	0.100	0.20	3 E-03	2 E-03	1000	1000
MW-23	9 E-05	6 E-05	0.100	0.20	9 E-05	6 E-05	50	30
MW-24	5 E-05	2 E-05	0.100	0.20	5 E-05	2 E-05	20	10
MW-25S	2 E-04	1 E-04	0.100	0.20	2 E-04	1 E-04	100	70
MW-25D	1 E-05	6 E-06	0.100	0.20	1 E-05	6 E-06	8	3
Minimum	1 E-05	6 E-06					8	3
Maximum	3 E-03	2 E-03					1000	1000
IN THE VICINITY OF SWMU 24								
P-2	8 E-04	4 E-04	0.025	0.20	2 E-04	1 E-04	100	60
P-3	2 E-03	1 E-03	0.025	0.20	4 E-04	3 E-04	200	200
P-4	1 E-06	4 E-08	0.025	0.01	6 E-06	2 E-07	3	0.1
MW-5	1 E-03	9 E-03	0.025	0.20	3 E-04	2 E-03	200	1000
MW-36	1 E-03	1 E-03	0.025	0.20	3 E-04	4 E-04	200	200
Minimum	1 E-06	4 E-08					3	0.1
Maximum	2 E-03	9 E-03					200	1000
SWMU 38 and 39								
MW-27	7 E-03	6 E-03	0.025	0.20	2 E-03	2 E-03	900	800
MW-28	1 E-03	1 E-03	0.025	0.20	3 E-04	3 E-04	100	100
MW-29	7 E-02	7 E-02	0.025	0.20	2 E-02	2 E-02	9000	9000
MW-30S	1 E-02	1 E-02	0.025	0.20	2 E-03	2 E-03	1000	1000
MW-30D	5 E-04	6 E-04	0.025	0.20	1 E-04	1 E-04	60	80
MW-31	2 E-04	1 E-04	0.025	0.20	4 E-05	3 E-05	20	20
MW-32	2 E-04	2 E-04	0.025	0.20	5 E-05	4 E-05	30	20
MW-33	2 E-04	2 E-04	0.025	0.20	5 E-05	5 E-05	30	20
MW-33 DUP	1 E-04	1 E-03	0.025	0.20	3 E-05	3 E-04	20	200
MW-34S	2 E-03	2 E-03	0.025	0.20	4 E-04	4 E-04	200	200
MW-34D	1 E-07	2 E-07	0.025	0.01	5 E-07	1 E-06	0.3	0.6
MW-35	1 E-07	4 E-08	0.025	0.01	5 E-07	2 E-07	0.3	0.1
MW-36	1 E-03	1 E-03	0.025	0.20	3 E-04	4 E-04	200	200
MW-37	2 E-03	2 E-03	0.025	0.20	6 E-04	5 E-04	300	300
Minimum	1 E-07	4 E-08					0.3	0.1
Maximum	7 E-02	7 E-02					9000	9000

Footnotes:

cm/sec - Centimeters per second.
ft/ft - Feet per feet.
ft/min - Feet per minute.
ft/year -Feet per year.
K - Hydraulic permeabity.
i - Hydraulic gradient.
n - Porosity (void volume / total volume).
v - Velocity = K i / n.

TABLE 4-3
Summary of Total Constituents Detected in Sludge
Samples Collected at SWMU 23 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	970619-LD-23 SM0001	970619-LD-23-SM9001	970619-LD-23-SM0002	970619-LD-23-SM0003	970619-LD-23 SM0004
LAB ID	84273-11	84273-17	84273-14	84273-15	84273-16
SAMPLE DATE	6/19/97	6/19/97	6/19/97	6/19/97	6/19/97
Volatile Organic Compounds (ug/kg):					
2-Butanone (MEK)	530	<1500	<2300	250	<1500
Acetone	1200	<1500	<2300	670	<1500
Ethylbenzene	<28	<150	<230	<24	220
Toluene	<28	<150	5100	200	520
Xylenes	96	<150	650	<24	900
Semivolatile Organic Compounds (ug/kg):					
Acenaphthylene	2000	4200	11000	8100	2700
Anthracene	<1800	<1900	3800	<1600	<1900
Benzo(a)anthracene	7800	15000	27000	45000	5300
Benzo(a)pyrene	7200	12000	31000	47000	6500
Benzo(b)fluoranthene	6100	11000	30000	57000	3800
Benzo(g,h,i)perylene	7200	8200	24000	40000	5000
Benzo(k)fluoranthene	6100	5000	21000	27000	5300
Chrysene	6100	10000	16000	39000	3700
Dibenzo(a,h)anthracene	<1800	<1900	3200	<1600	<1900
Fluoranthene	7200	10000	25000	24000	5700
Fluorene	<1800	<1900	5400	<1600	<1900
Indeno(1,2,3-cd)pyrene	6700	8200	21000	39000	5500
Naphthalene	<1800	<1900	<3000	<1600	4100
Phenanthrene	2600	3500	14000	<1600	4400
Pyrene	7200	14000	19000	31000	3600
4-methylphenol (p-cresol)	2700	2800	<3000	3000	10000
Total PAHs	66200	101100	251400	357100	55600

TABLE 4-3
Summary of Total Constituents Detected in Sludge
Samples Collected at SWMU 23 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	970619-LD-23 SM0001	970619-LD-23-SM9001	970619-LD-23-SM0002	970619-LD-23-SM0003	970619-LD-23 SM0004
LAB ID	84273-11	84273-17	84273-14	84273-15	84273-16
SAMPLE DATE	6/19/97	6/19/97	6/19/97	6/19/97	6/19/97
<u>Metals (mg/kg):</u>					
Arsenic, Total	11 J	6.3 J	11.5 J	42 J	<6 UJ
Barium, Total	160	130	450	390	250
Chromium, Total	65	64	130	190	130
Copper, Total	32	31	110	240	87
Lead, Total	18	18	51	50	35
Mercury, Total	<1.396	1.9	8.6	7.7	7.2
Nickel, Total	68	68	140	270	200
Selenium, Total	45	50	150	117	62
Silver, Total	<5.6	<5.7	8	5.7	<6
Zinc, Total	140 J	120 J	300 J	280 J	220 J
Cyanide, Total (mg/kg)	20.3 J	16.1 J	<1.8 R	136 J	4 J
Percent Solids (%)	18	18	12	21	17

NOTE: Sludge sample 970619-LD-23-SM9001 is the duplicate of 970619-LD-23-SM0001.
J - Positive results have been classified as qualitative during data validation.
UJ - Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
R - Data classified as unusable.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.

TABLE 4-4
Summary of TCLP Constituents Detected in Sludge
Samples Collected at SWMU 23 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	RCRA TC Level	970619-LD-23-SM0001	970619-LD-23-SM9001	970619-LD-23-SM0002	970619-LD-23-SM0003	970619-LD-23 SM0004
LAB ID		84273-11	84273-17	84273-14	84273-15	84273-16
SAMPLE DATE		6/19/97	6/19/97	6/19/97	6/19/97	6/19/97
TCLP-Volatile Organic Compounds (mg/L):		ND	NA	ND	ND	ND
TCLP-Semivolatile Organic Compounds (mg/L):		ND	NA	ND	ND	ND
TCLP-Organochlorine Pesticides (mg/L):		ND	NA	ND	ND	ND
TCLP-Chlorinated Herbicides (mg/L):		ND	NA	ND	ND	ND
TCLP-Metals (mg/L):						
Barium	100	12	NA	18	7.6	3.5
Chromium	5	<0.03	NA	0.18	<0.01	0.12

NA Not Analyzed.
ND Not detected. Analytes in this group were all below their respective detection limits.
mg/L Milligrams per liter.

TABLE 4-5
Summary of Constituents Detected in Subsurface
Soil Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC	970806-LD-23-SL0021(14-16)	970806-LD-23-SL0021(20-22)	970806-LD-23-SL9021	970806-LD-23-SL0022(0-2)	970806-LD-23-SL0023(12-14)
LAB ID	Soil Ingestion-	85785-6	85785-5	85785-7	85785-2	85785-3
SAMPLE DATE	Residential 1/	8/6/97	8/6/97	8/6/97	8/6/97	8/6/97
Volatile Organic Compounds (ug/kg):						
Acetone	7,800,000	<72	<75	<77	<57	<60
Semivolatile Organic Compounds (ug/kg):		ND	ND	ND	ND	ND
Metals (mg/kg):						
Arsenic, Total	0.43 2/	3.6 J	2.2 J	2 J	4.6	2.9
Barium, Total	5,500	39 J	82	63 J	25	14
Beryllium, Total	160	<0.7 UJ	<0.7	<0.8 UJ	<0.6	<0.6
Cadmium, Total	39	<0.7 UJ	<0.7 UJ	<0.8 UJ	<0.6 UJ	<0.6 UJ
Chromium, Total	230 3/	<1.4 UJ	9.3	15 UJ	11	<1.2
Copper, Total	3,100	<2.9 UJ	<3	<3.1 UJ	<2.3	<2.4
Lead, Total	400	<3.6	<3.7	<3.9	13	<3
Nickel, Total	1,600	<2.9 UJ	28	23 UJ	<2.3	<2.4
Zinc, Total	23,000	41	63	54	41	32
Cyanide, Total (mg/kg):	1600	0.43	0.34	0.46	<0.2	0.31
Percent Solids (%)	NS	69	67	65	88	84

Footnotes on Page 2

TABLE 4-5
Summary of Constituents Detected in Subsurface
Soil Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC	970806-LD-23-SL0023(24-26)	970805-LD-23-SL0024(7-9)	970805-LD-23-SL0024(14-16)	970805-LD-23-SL0025(19-21)
LAB ID	Soil Ingestion-	85785-4	85657-17	85657-19	85657-16
SAMPLE DATE	Residential [1/]	8/6/97	8/5/97	8/5/97	8/5/97
Volatile Organic Compounds (ug/kg):					
Acetone	7,800,000	<61	<61	<72	110
Semivolatile Organic Compounds (ug/kg):		ND	ND	ND	ND
Metals (mg/kg):					
Arsenic, Total	0.43 [2/]	$\boxed{6.3}$	$\boxed{13}$	$\boxed{30}$	$\boxed{3.8}$
Barium, Total	5,500	76	43	53	180
Beryllium, Total	160	<0.6	<0.6	0.7	<0.6
Cadmium, Total	39	<0.6 UJ	2.5	2.4	<0.6
Chromium, Total	230 [3/]	<1.2	7	19	15
Copper, Total	3,100	<2.5	5	22	<2.5
Lead, Total	400	10	4.4	19	<3.2
Nickel, Total	1,600	8.8	45	66	18
Zinc, Total	23,000	70	83	430	47
Cyanide, Total (mg/kg):	1600	<0.3	<0.3	<0.3	<0.3
Percent Solids (%)	NS	82	82	70	78

NOTE: Sample 970806-LD-23-SL9021 is the duplicate of 970806-LD-23-SL0021 (20-22)

Explanation:

J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
ND	Not detected. Analytes in this group were all below their respective detection limits.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
$\boxed{}$	Concentration exceeds Residential RBC
1/	Source: USEPA Region III Risk Based Concentrations (RBC), April 13, 2000.
2/	RBC for Arsenic as a carcinogen.
3/	RBC for Chromium VI.

TABLE 4-6
Summary of Constituents Detected in Groundwater
Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA MCL	970818-LD-23-GW0021	970818-LD-23-GW0022	970818-LD-23-GW0023	970818-LD-23-GW0024	970819-LD-23-GW0025D	970819-LD-23 GW9025D	970819-LD-23-GW0025S
LAB ID		86126-2	86126-1	86126-3	86126-4	86126-7	86126-12	86126-11
SAMPLE DATE		35660	35660	35660	35660	35661	35661	35661
<u>Volatile Organic Compounds(ug/L)</u>								
Acetone	610 [1/]	<50	110	<50	<50	<50	<50	<50
<u>Semivolatile Organic Compounds(ug/L)</u>		ND	ND	ND	ND	ND	ND	ND
<u>Metals (mg/L):</u>								
Barium, Total	2	0.14	0.05	0.09	0.07	0.28	0.29	0.1
Chromium, Total	0.1	0.02	<0.01	0.01	0.01	0.03	0.03	<0.01
Copper, Total	1.3	<0.02	<0.02	<0.02	<0.02	0.02	0.02	0.02
Nickel, Total	0.1	0.02	<0.02	<0.02	0.02	0.04	0.04	<0.02
Zinc, Total	5	<0.02	0.05	0.11	0.09	0.09	0.11	0.06
Cyanide, Total (mg/L):	0.2	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

ND = Not Detected

[1/] USEPA Region III Risk Based Concentration (RBC) for tap water, April 13, 2000.

TABLE 4-7
Summary of Total Constituents Detected in Sludge Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	970619-LD-24-SM0001	970619-LD-24-SM9001	970619-LD-24-SM0002	970619-LD-24-SM0003	970619-LD-24-SM0004
LAB ID	84273-6	84273-10	84273-7	84273-8	84273-9
SAMPLE DATE	6/19/97	6/19/97	6/19/97	6/19/97	6/19/97
Volatile Organic Compounds (ug/kg):	ND	ND	ND	ND	ND
Semivolatie Organic Compounds (ug/kg):	ND	ND	ND	ND	ND
Metals (mg/kg):					
Antimony, Total	17	17	18	18	15
Arsenic, Total	18 J	17 J	15 J	15 J	15 J
Barium, Total	200	190	240	240	220
Beryllium, Total	2.4	2.6	2.4	3.1	2.6
Cadmium, Total	8.7	9	7.9	8.2	11
Chromium, Total	120	110	180	160	50
Copper, Total	110	110	85	87	130
Lead, Total	310	330	240	1703	530
Nickel, Total	36	36	43	42	33
Silver, Total	4.3	4.8	2.9	2.8	6.1
Zinc, Total	3100 J	3000 J	2900 J	2300 J	4500 J
Cyanide, Total (mg/kg):	3.8 J	3.1 J	3.2 J	2.4 J	4.7 J
Percent Solids (%)	83	84	85	86	82

J - Positive results have been classified as qualitative during data validation.
ND - Not detected. Analytes in this group were all below their respective detection limits.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
NOTE: Sludge sample 970619-LD-24-SM9001 is the duplicate of 970619-LD-24-SM0001

TABLE 4-8
Summary of TCLP Constituents Detected in Sludge
Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	RCRA TC Level	970619-LD-24-SM0001	970619-LD-24-SM9001	970619-LD-24-SM0002	970619-LD-24-SM0003	970619-LD-24-SM0004
LAB ID		84273-6	84273-10	84273-7	84273-8	84273-9
SAMPLE DATE		6/19/97	6/19/97	6/19/97	6/19/97	6/19/97
TCLP-Volatile Organic Compounds (mg/L):		ND	ND	ND	ND	ND
TCLP-Semivolatie Organic Compounds (mg/L):		ND	ND	ND	ND	ND
TCLP-Organochlorine Pesticides (mg/L):		ND	ND	ND	ND	ND
TCLP-Chlorinated Herbicides (mg/L):		ND	ND	ND	ND	ND
TCLP-Metals (mg/L):						
Barium	100	1	0.9	0.8	0.6	1.2
Cadmium	1	0.03	0.03	0.01	<0.01	0.06

NOTE: Sludge sample 970619-LD-24-SM9001 is the duplicate of 970619-LD-24-SM0001.
ND - Not detected. Analytes in this group were all below their respective detection limits.
mg/L - Milligrams per liter.

TABLE 4-9
Summary of Consituents Detected in Surficial
Soil Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC Soil Ingestion-	970618-LD-24-SL0002	970617-LD-24-SL0003	970617-LD-24-SL0004	970617-LD-24-SL0005	970617-LD-24-SL0006	970617-LD-24-SL9001	970617-LD-24-SL0007	970618-LD-24-SL0008
LAB ID	Residential [1/]	84221-12	84221-13	84221-14	84221-15	84221-16	84221-11	84221-19	84221-20
SAMPLE DATE		6/18/97	6/17/97	6/17/97	6/17/97	6/17/97	6/17/97	6/17/97	6/18/97
Volatile Organic Comounds (ug/kg):									
Acetone	7,800,000	<70	<57	<68	<65	<60	<61	<93	<66
Semivolatile Organic Compounds (ug/kg):									
Acenaphthene	4,700,000	<460	<380	<450	<430	<400	<400	<610	<430
Acenaphthylene	NS	<460	580	<450	<430	<400	<400	780	<430
Anthracene	23,000,000	<460	410	<450	<430	<400	<400	<610	<430
Benzo(a)anthracene	870	<460	2050	<450	640	<400	<400	590	<430
Benzo(a)pyrene	87	<460	1400	<450	480	<400	<400	700	<430
Benzo(b)fluoranthene	870	<460	1500	<450	<430	<400	<400	980	<430
Benzo(g,h,i)perylene	NS	<460	1500	<450	<430	<400	<400	1600	<430
Benzo(k)fluoranthene	8,700	<460	980	<450	500	<400	<400	780	<430
Chrysene	87,000	<460	1400	<450	470	<400	<400	<610	<430
Dibenzo(a,h)anthracene	87	<460	<380	<450	<430	<400	<400	<610	<430
Fluoranthene	3,100,000	<460	2200	<450	690	<400	<400	<610	<430
Fluorene	3,100,000	<460	<380	<450	<430	<400	<400	<610	<430
Indeno(1,2,3-cd)pyrene	870	<460	1300	<450	<430	<400	<400	1500	<430
Naphthalene	1,600,000	<460	<380	<450	<430	<400	<400	<610	<430
Phenanthrene	NS	<460	1200	<450	<430	<400	<400	<610	<430
Pyrene	2,300,000	<460	1600	<450	460	<400	<400	<610	<430

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TABLE 4-9
Summary of Consituents Detected in Surficial
Soil Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC Soil Ingestion-	970618-LD-24-SL0002	970617-LD-24-SL0003	970617-LD-24-SL0004	970617-LD-24-SL0005	970617-LD-24-SL0006	970617-LD-24-SL9001	970617-LD-24-SL0007	970618-LD-24-SL0008
LAB ID	Residential [1/]	84221-12	84221-13	84221-14	84221-15	84221-16	84221-11	84221-19	84221-20
SAMPLE DATE		6/18/97	6/17/97	6/17/97	6/17/97	6/17/97	6/17/97	6/17/97	6/18/97
Metals (mg/kg):									
Antimony, Total	31	<7 UJ	<5.8 UJ	<6.7 UJ	13 J	<6 UJ	<6.1 UJ	<9.4 UJ	<6.6 UJ
Arsenic, Total	0.43 [2/]	5.5 J	9.1 J	9.9 J	12.8 J	8.1 J	7.5 J	21 J	9 J
Barium, Total	5,500	34	43	44	180	23	36	93	46
Beryllium, Total	160	<0.7	<0.58	<0.67	2.1	<0.6	<0.61	<0.94	<0.66
Cadmium, Total	39	<0.7	0.83	<0.67	10	<0.6	<0.61	2	1.2
Chromium, Total	230 [3/]	20	11	22	120	17	18	25	10
Copper, Total	3,100	14	13	19	92	10	4.4	29	21
Lead, Total	400	<3.5	20	36	300	19	19	76	49
Mercury, Total	7.8	<0.35	<0.29	<0.34	<0.32	<0.3	<0.3	0.51	<0.33
Nickel, Total	1,600	6.3	5.9	8.3	39	4.6	5	24	12
Silver, Total	390	<1.4	<1.2	<1.3	2.9	<1.2	<1.2	<1.9	<1.3
Zinc, Total	23,000	25	84	240	2200	110	97	610	460
Cyanide, Total (mg/kg)	1,600	<0.3	1.3 J	2.2	4.1 J	0.9 J	0.7 J	2.8 J	0.8 J
Percent Solids (%)	NS	71	87	75	78	84	83	55	76

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TABLE 4-9
Summary of Consituents Detected in Surficial
Soil Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC Soil Ingestion-	970618-LD-24-SL0009	970618-LD-24-SL0010	970618-LD-24-SL0011	970618-LD-24-SL0012	970618-LD-24-SL0013	970618-LD-24-SL0014	970618-LD-24-SL0015	970618-LD-24-SL0016
LAB ID	Residential 1/	84221-21	84221-22	84221-23	84221-24	84221-25	84221-26	84221-27	84221-28
SAMPLE DATE		6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97
Volatile Organic Comounds (ug/kg):									
Acetone	7,800,000	<68	<68	<63	150	<68	<75	<62	<68
Semivolatile Organic Compounds (ug/kg):									
Acenaphthene	4,700,000	<440	<450	<420	<410	<450	<4900	<410	460
Acenaphthylene	NS	<440	<450	568	<410	<450	9400	<410	1400
Anthracene	23,000,000	<440	<450	730	<410	<450	10000	<410	1000
Benzo(a)anthracene	870	<440	<450	$\boxed{3500}$	760	<450	$\boxed{63000}$	790	$\boxed{5900}$
Benzo(a)pyrene	87	<440	<450	$\boxed{2100}$	$\boxed{660}$	<450	$\boxed{36000}$	$\boxed{430}$	$\boxed{3400}$
Benzo(b)fluoranthene	870	<440	<450	$\boxed{2000}$	540	<450	$\boxed{33000}$	<410	$\boxed{3600}$
Benzo(g,h,i)perylene	NS	<440	<450	2000	720	<450	22000	<410	3900
Benzo(k)fluoranthene	8,700	<440	<450	1800	660	<450	$\boxed{16000}$	<410	1500
Chrysene	87,000	<440	<450	2100	560	<450	39000	530	3200
Dibenzo(a,h)anthracene	87	<440	<450	<420	<410	<450	<4900	<410	$\boxed{570}$
Fluoranthene	3,100,000	<440	<450	3200	860	<450	46000	1100	3500
Fluorene	3,100,000	<440	<450	490	<410	<450	<4900	<410	1200
Indeno(1,2,3-cd)pyrene	870	<440	<450	$\boxed{1800}$	650	<450	$\boxed{22000}$	<410	$\boxed{3600}$
Naphthalene	1,600,000	<440	<450	490	<410	<450	6300	<410	680
Phenanthrene	NS	<440	<450	1700	<410	<450	14000	500	2600
Pyrene	2,300,000	<440	<450	3100	590	<450	55000	790	5200

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TABLE 4-9
Summary of Consituents Detected in Surficial Soil Samples Collected at SWMU 24 in June 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC Soil Ingestion-	970618-LD-24-SL0009	970618-LD-24-SL0010	970618-LD-24-SL0011	970618-LD-24-SL0012	970618-LD-24-SL0013	970618-LD-24-SL0014	970618-LD-24-SL0015	970618-LD-24-SL0016
LAB ID	Residential [1/]	84221-21	84221-22	84221-23	84221-24	84221-25	84221-26	84221-27	84221-28
SAMPLE DATE		6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97	6/18/97
Metals (mg/kg):									
Antimony, Total	31	<6.7 UJ	<6.8 UJ	<6.3 UJ	<6.2 UJ	<6.8 UJ	<7.5 UJ	<6.2 UJ	7.4 J
Arsenic, Total	0.43 [2/]	9.1 J	16.4 J	9.9 J	13.5 J	7.1 J	19 J	7.7 J	13.7 J
Barium, Total	5,500	28	100	160	99	81	140	65	190
Beryllium, Total	160	<0.67	<0.68	1.4	1.2	1.2	<0.7	<0.62	1.7
Cadmium, Total	39	<0.67	2.3	2	1.3	<0.68	4.2	<0.62	7.3
Chromium, Total	230 [3/]	8.1	162	25	15	11	22	12	47
Copper, Total	3,100	12	41	39	30	15	68	14	79
Lead, Total	400	13	120	97	56	13	190	21	260
Mercury, Total	7.8	<0.36	0.35	<0.32	<0.31	<0.34	0.52	<0.31	0.63
Nickel, Total	1,600	15	23	17	45	18	26	12	30
Silver, Total	390	<1.3	1.6	<1.3	<1.2	<1.4	2	<1.2	3.2
Zinc, Total	23,000	120	780	740	470	68	1500	160	1900
Cyanide, Total (mg/kg)	1,600	0.8 J	1.7 J	0.7	1	1.2	4.3	5.6	2
Percent Solids (%)	NS	75	74	79	82	73	67	81	75

J = Positive results have been classified as qualitative during data validation.
UJ = Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
[1/] Source: USEPA Region III Risk-Based Conhcentrations (RBC), April 13, 2000.
[2/] RBC for Arsenic as a carcinogen.
[3/] RBC for Chromium VI.
[box] Concentration exceeds Residential RBC.

TABLE 4-10
Summary of Total Constituents Detected in Sludge Samples Collected at SWMU 39 in June 1997 Land Disposal Areas RFI Sloss Industries Corporation

SAMPLE ID	970616-LD-39-SM0002	970616-LD-39-SM0003	970616-LD-39-SM9001	970619-LD-39-SM0005	970619-LD-39-SM0006
LAB ID	84221-5	84221-6	84221-3	84273-4	84273-5
SAMPLE DATE	6/16/97	6/16/97	6/16/97	6/19/97	6/19/97
Volatile Organic Compounds (ug/kg):	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (ug/kg):					
Benzo(k)fluoranthene	<400	<380	<370	<410	630
Metals (mg/kg):					
Antimony, Total	12 J	13	12 J	15	11
Arsenic, Total	7.6 J	7 J	7.6 J	8.8 J	3.8 J
Barium, Total	260	230	220	200	85
Beryllium, Total	1.6	2.1	2.3	<0.6	<0.6
Cadmium, Total	11	8.3	12	6.5	5
Copper, Total	160	110	120	<2.5	7.2
Lead, Total	320	220	220	30	320
Nickel, Total	25	20	20	12	9.6
Silver, Total	4.6	3.4	3	<1.2	<1.3
Zinc, Total	3100	2900 J	2800	600 J	1400 J
Cyanide, Total (mg/kg):	3.2 J	4.7 J	4.8 J	8.3 J	<0.2 R
Percent Solids (%)	84	89	90	82	79

NOTE: Sample 970616-LD-39-SM9001 is the duplicate of 970616-LD-39-SM0003.
J - Positive results have been classified as qualitative during data validation.
R - Data classified as unusable.
ND - Not detected. Analytes in this group were all below their respective detection limits.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.

TABLE 4-11
Summary of TCLP Constituents Detected in Sludge
Samples Collected at SWMU 39 in June 1997
Land Disposal Areas
Sloss Industries Corporation

SAMPLE ID	RCRA TC Level	970616-LD-39-SM0002	970616-LD-39-SM0003	970616-LD-39-SM9001	970619-LD-39-SM0005	970619-LD-39-SM0006
LAB ID		84221-5	84221-6	84221-3	84273-4	84273-5
SAMPLE DATE		6/16/97	6/16/97	6/16/97	6/19/97	6/19/97
TCLP-Volatile Organic Compounds (mg/L):		ND	ND	NA	ND	ND
TCLP-Semivolatie Organic Compounds (mg/L):		ND	ND	NA	ND	ND
TCLP-Organochlorine Pesticides (mg/L):		ND	ND	NA	ND	ND
TCLP-Chlorinated Herbicides (mg/L):		ND	ND	NA	ND	ND
TCLP-Metals(mg/L):						
Barium	100	2.8	0.91	NA	1.3	<0.3
Cadmium	1	0.036	<0.023	NA	<0.01	<0.01

ND - Not detected. Analytes in this group were all below their respective detection limits.
mg/L - Milligrams per liter.
NA - Not analyzed.

TABLE 4-12
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

		SWMU 38						
SAMPLE ID	USEPA RBC Soil Ingestion-	970804-LD-38-SL0026(10-12)	970804-LD-38-SL9026	970804-LD-38-SL0026(18-20)	970805-LD-38-SL0027(11-13)	970805-LD-38-SL0027(22-24)	970808-LD-38-SL0027(22-24)	970807-LD-38-SL0028(8-10)
LAB ID	Residential[1/]	85657-5	85657-8	85657-6	85657-13	85657-14	85785-18	85785-12
SAMPLE DATE		8/4/97	8/4/97	8/4/97	8/5/97	8/5/97	8/8/97	8/7/97
Volatile Organic Compounds (ug/kg):								
Toluene	16,000,000	<7	8	<6	<6	NA	<7	<7
Semivolatile Organic Comounds (ug/kg):		ND	ND	ND	ND	ND	NA	ND
Metals (mg/kg):								
Antimony, Total	31	<6.7	<6.7	<5.9	<6.1	<7.6	NA	9.6
Arsenic, Total	0.43 [2/]	3.3 J	3.5 J	1.8 J	4.1	2.3	NA	<1.3
Barium, Total	5,500	110	110	99	8.6	17	NA	19
Beryllium, Total	160	1.9	1.6	<0.6	<0.6	<0.8	NA	<0.6
Chromium, Total	230[3/]	9.3	8.5	15	15	2.4	NA	15
Copper, Total	3,100	6.5	15	6.5	<2.4	<3	NA	6.1
Lead, Total	400	6.4	5.5	<3	<3	<3.8	NA	7.9
Nickel, Total	1,600	32	29	20	<2.4	4.4	NA	<2.7
Silver, Total	390	<1.3 UJ	<1.3 UJ	<1.2 UJ	<1.2 UJ	<1.5 UJ	NA	<1.3 UJ
Zinc, Total	23,000	76	51	60	23	18	NA	31
Cyanide, Total (mg/kg):	1,600	<0.3	<0.3	<0.2	<0.2	<0.3	NA	<0.3
Percent Solids (%)	NS	76	76	87	83	66	72	75

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TABLE 4-12
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

		SWMU 38						
SAMPLE ID	USEPA RBC Soil Ingestion-	970807-LD-38-SL0028(13-15)	970807-LD-38-SL0029(15-17)	970807-LD-38-SL0029(19-21)	970807-LD-38-SL0030(9-11)	970807-LD-38-SL0030(17-19)	970808-LD-38-SL0037(4-6)	970808-LD-38-SL0037(8-10)
LAB ID	Residential[1/]	85785-14	85785-10	85785-11	85785-8	85785-9	85785-21	85785-20
SAMPLE DATE		8/7/97	8/7/97	8/7/97	8/7/97	8/7/97	8/8/97	8/8/97
Volatile Organic Compounds (ug/kg):								
Toluene	16,000,000	<7	<7	<7	<6	<7	<7	<7
Semivolatile Organic Comounds (ug/kg):		ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg):								
Antimony, Total	31	<6.8	<6.7	<6.7	<5.9	<6.7	<6.7	<6.7
Arsenic, Total	0.43 [2/]	1.8	<1.3	2.1	4.3 J	5.1 J	2	3.5
Barium, Total	5,500	120	70	130	61	130	2.4	94
Beryllium, Total	160	<0.7	<0.7	2.8	<0.6 UJ	<0.8 UJ	<0.7	<0.7
Chromium, Total	230[3/]	10	6	3.1	9.4	11	19	5.7
Copper, Total	3,100	<2.7	5.2	5.5	<2.3 UJ	110 J	<2.7	<2.7
Lead, Total	400	36	5	<3.4	<2.9	<3.3	9.4	11
Nickel, Total	1,600	23	5.4	24	<2.3	<2.7	<2.7	3
Silver, Total	390	<1.4 UJ	<1.3 UJ	<1.3 UJ	<1.2	7.6	<1.3 UJ	<1.3 UJ
Zinc, Total	23,000	62	47	79	54	190	10	63
Cyanide, Total (mg/kg):	1,600	<0.3	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3
Percent Solids (%)	NS	74	75	75	86	75	75	75

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TABLE 4-12
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

		SWMU 39						
SAMPLE ID	USEPA RBC Soil Ingestion-	970808-LD-39-SL0033(11-13)	970805-LD-39-SL0034(10-12)	970808-LD-39-SL0034(10-12)	970808-LD-39-SL0035(10-12)	970804-LD-39-SL0036(5-7)	970804-LD-39-SL9036	970804-LD-39-SL0036(10-12)
LAB ID	Residential[1/]	85785-23	85657-15	85785-19	85785-22	85657-2	85657-7	85657-4
SAMPLE DATE		8/8/97	8/5/97	8/8/97	8/8/97	8/4/97	8/4/97	8/4/97
Volatile Organic Compounds (ug/kg):								
Toluene	16,000,000	<6	NA	<6	<7	<6	<6	<7
Semivolatile Organic Comounds (ug/kg):		ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg):								
Antimony, Total	31	<6.2	<6	NA	<7.5	<6	<6.1	<7.3
Arsenic, Total	0.43 [2/]	5	5.2	NA	2.7	4.2	3.5 J	4.8
Barium, Total	5,500	420	180	NA	130	140	140	110
Beryllium, Total	160	<0.6	<0.6	NA	<0.7	<0.6	<0.6	<0.7
Chromium, Total	230[3/]	10	13	NA	11	8.9	7.9	11
Copper, Total	3,100	4.3	<2.4	NA	<3	16	21	9.3
Lead, Total	400	9.3	10	NA	7.9	28	16	6
Nickel, Total	1,600	22	6	NA	9.3	7.1	7.2	11
Silver, Total	390	<1.2 UJ	<1.2 UJ	NA	<1.5 UJ	<2.1 UJ	<1.2 UJ	<1.5 UJ
Zinc, Total	23,000	53	46	NA	57	58	57	96
Cyanide, Total (mg/kg):	1,600	1.25	0.7	NA	<0.3	<0.2	<0.2	<0.3
Percent Solids (%)	NS	82	83	84	67	84	83	69

NA Not Analyzed NS No Standard
ND Not detected. Analytes in this group were all below their respective detection limits.
J Positive results have been classified as qualitative during data validation.
U Classified as nondetected.
ug/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
[1/] Source: USEPA Region III Risk Based Concentrations (RBC), April 13, 2000.
[2/] RBC for Arsenic as a carcinogen. ▭ Concentration exceeds Residential RBC.
[3/] RBC for chromium VI
Note: Sample 970804-LD-38-SL9025 is the duplicate of 970804-LD-38-SL0025(10-12);
Sample 970804-LD-39-SL9036 is the duplicate of 970804-LD-39-SL0036(5-7).

TABLE 4-13
Summary of Constituents Detected in Groundwater Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

		SWMU 38						
SAMPLE ID	USEPA MCL	970821-LD-38-GW0026	970819-LD-38-GW0027	970819-LD-38-GW0028	970819-LD-38-GW0029	970821-LD-38 GW0030D	970821-LD-38 GW0030S	970821-LD-38-GW0037
LAB ID		86173-19	86173-2	86126-14	86126-13	86173-17	86173-15	86173-11
SAMPLE DATE		8/21/97	8/19/97	8/19/97	8/19/97	8/21/97	8/21/97	8/21/97
Volatile Organic Compounds (ug/L):								
Acetone	610 1/	120	<50	<50	<50	120	1000	<50
Benzene	5	13	<5	<5	<5	<5	<5	<5
Toluene	1000	7	<2	<2	<2	<2	<2	<2
Trichloroethene	5	<2	<2	<2	3	<2	<2	<2
Xylenes	10000	23	<5	<5	<5	<5	<5	<5
Semivolatile Organic Compounds (mg/L):		ND	ND	ND	ND	ND	ND	ND
Metals (mg/L):								
Barium, Total	2	0.26	0.08	0.14	0.51	0.5	0.13	0.07
Chromium, Total	0.1	0.02	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Copper, Total	1.3	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
Zinc, Total	5	0.2	<0.02	<0.02	0.06	<0.02	0.18	0.05
Lead, Total	0.015	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Silver, Total	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide, Total (mg/L)	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

TABLE 4-13
Summary of Constituents Detected in Groundwater Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

		SWMU 39							
SAMPLE ID	USEPA MCL	970821-LD-39-GW0031	970821-LD-39-GW0032	970820-LD-39-GW0033	970821-LD-39-GW0034D	970820-LD-39-GW0034S	970820-LD-39-GW9034S	970821-LD-39-GW0035	970821-LD-39-GW0036
LAB ID		86173-13	86173-14	86173-8	86173-18	86173-6	86173-7	86173-12	86173-9
SAMPLE DATE		8/21/97	8/21/97	8/20/97	8/21/97	8/20/97	8/20/97	8/21/97	8/21/97
Volatile Organic Compounds (ug/L):									
Acetone	610 [1/]	120	<50	<50	66	<50	<50	<50	<50
Benzene	5	<5	<5	<5	6	<5	<5	<5	<5
Toluene	1000	<2	<2	<2	<2	<2	<2	<2	<2
Trichloroethene	5	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes	10000	<5	<5	<5	7	<5	<5	<5	<5
Semivolatile Organic Compounds (mg/L):		ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/L):									
Barium, Total	2	0.12	0.03	0.1	0.03	0.02	0.02	0.07	0.02
Chromium, Total	0.1	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Copper, Total	1.3	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
Zinc, Total	5	<0.02	<0.02	<0.02	0.21	<0.02	<0.02	<0.02	0.05
Lead, Total	0.015	<0.025	<0.025	<0.025	0.04	<0.025	<0.025	<0.025	<0.025
Silver, Total	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24
Cyanide, Total (mg/L)	0.2	0.03	0.38	0.14	<0.02	0.21	0.22	0.07	<0.02

ND Not detected. Analytes in this group were all below their respective detection limits.
mg/L Milligrams per liter.
ug/L Micrograms per liter.
[1/] Source: USEPA Region III Risk Based Concentrations (RBC) for tap water, April 13, 2000.
[box] Concentration exceeds USEPA MCL.

TABLE 5-1
OCCURENCE SUMMARY FOR SUBSURFACE SOIL SAMPLES FROM SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	EPC
VOCs (µg/kg)							
Acetone	1 / 8	57 - 75	110 - 110	110	42	61	61
Metals/Inorganics (mg/kg)							
Arsenic	8 / 8	NA	2.2 - 30	8.3	8.2	22	22
Barium	8 / 8	NA	14 - 180	64	67	160	160
Beryllium	1 / 8	0.60 - 0.70	0.70	0.70	0.36	0.45	0.45
Cadmium	2 / 8	0.60 - 0.70	2.4 - 2.5	2.5	0.83	2.7	2.5
Chromium	5 / 8	1.2 - 1.4	7.0 - 19	13	14	280	19
Copper	2 / 8	2.3 - 3.0	5.0 - 22	14	3.8	16	16
Cyanide	3 / 8	0.20 - 0.30	0.31 - 0.43	0.36	0.23	0.36	0.36
Lead	4 / 8	3.0 - 3.7	4.4 - 19	12	7.2	29	19
Nickel	5 / 8	2.3 - 2.9	8.8 - 66	33	35	1,000	66
Zinc	8 / 8	NA	32 - 430	100	93	230	230

EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
SQLs	Practical sample quantitation limits for the non-detects.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs	Volatile organic compounds.

TABLE 5-2
OCCURRENCE SUMMARY FOR SLUDGE SAMPLES FROM SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	TEF	EPC
VOCs (µg/kg)								
2-Butanone (MEK)	2 / 4	1,060 - 1,060 *	250 - 530	390	470	920	NAP	530
Acetone	2 / 4	1,500 - 2,300	670 - 1,200	940	950	1,500	NAP	1,200
Ethylbenzene	1 / 4	24 - 230	220	220	130	510,000	NAP	220
Toluene	3 / 4	28 - 28	200 - 5,100	1,900	5,800	3.5E+13	NAP	5,100
Xylenes	3 / 4	24 - 24	96 - 900	550	1,200	4.E+09	NAP	900
SVOCs (µg/kg)								
4-Methylphenol	3 / 4	3,000	2,800 - 10,000	5,300	4,600	54,000	NAP	10,000
Acenaphthylene	4 / 4	NA	2,700 - 11,000	6,500	6,900	35,000	NAP	11,000
Anthracene	1 / 4	1,600 - 1,900	3,800	3,800	1,700	14,000	NAP	3,800
Benzo(a)anthracene	4 / 4	NA	5,300 - 45,000	23,000	27,000	700,000	0.1	4,500
Benzo(b)fluoranthene	4 / 4	NA	3,800 - 57,000	25,000	33,000	7,100,000	0.1	5,700
Benzo(g,h,i)perylene	4 / 4	NA	5,000 - 40,000	19,000	22,000	750,000	NAP	40,000
Benzo(k)fluoranthene	4 / 4	NA	5,300 - 27,000	15,000	16,000	250,000	0.01	270
Benzo(a)pyrene	4 / 4	NA	6,500 - 47,000	24,000	27,000	620,000	1.0	47,000
Chrysene	4 / 4	NA	3,700 - 39,000	17,000	20,000	810,000	0.001	39
Dibenzo(a,h)anthracene	1 / 4	1,600 - 1,900	3,200	3,200	1,500	8,100	1.0	3,200
Fluoranthene	4 / 4	NA	5,700 - 25,000	16,000	18,000	130,000	NAP	25,000
Fluorene	1 / 4	1,600 - 1,900	5,400	5,400	2,100	51,000	NAP	5,400
Indeno(1,2,3-cd)pyrene	4 / 4	NA	5,500 - 39,000	18,000	21,000	440,000	0.1	3,900
Naphthalene	1 / 4	1,600 - 3,000	4,100	4,100	1,900	17,000	NAP	4,100
Phenanthrene	3 / 4	1,600	3,500 - 14,000	7,300	7,200	1,400,000	NAP	14,000
Pyrene	4 / 4	NA	3,600 - 31,000	17,000	20,000	540,000	NAP	31,000
Metals/Inorganics (mg/kg)								
Arsenic	3 / 4	6.0	11 - 42	22	20	1,700	NAP	42
Barium	4 / 4	NA	160 - 450	310	320	830	NAP	450

Footnotes on page 2.

TABLE 5-2
OCCURRENCE SUMMARY FOR SLUDGE SAMPLES FROM SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	TEF	EPC
Metals/Inorganics (mg/kg)								
Chromium	4 / 4	NA	65 - 190	130	130	320	NAP	190
Copper	4 / 4	NA	32 - 240	120	130	1,900	NAP	240
Cyanide	3 / 4	1.8	4.0 - 136	53	100	4.4E+09	NAP	140
Lead	4 / 4	NA	18 - 51	39	40	110	NAP	51
Mercury	4 / 4	NA	1.9 - 8.6	6.4	7.1	52	NAP	8.6
Nickel	4 / 4	NA	68 - 270	170	180	750	NAP	270
Selenium	4 / 4	NA	50 - 150	95	98	300	NAP	150
Silver	2 / 4	5.6 - 6.0	5.7 - 8.0	6.9	5.0	15	NAP	8
Zinc	4 / 4	NA	140 - 300	240	240	430	NAP	300

*	When SQL/2 exceeds the maximum detect (i.e., an unusually high SQL), twice the maximum detect is used as the proxy concentration.
EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
SQLs	Practical sample quantitation limits for the non-detects.
SVOCs	Semivolatile organic compounds.
TEF	Toxic equivalency factor for carcinogenic PAHs.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs	Volatile organic compounds.

TABLE 5-3
OCCURENCE SUMMARY FOR GROUNDWATER SAMPLES FROM SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	EPC
VOCs (µg/L)							
Acetone	1 / 6	50 - 50	110	110	38	84	84
Metals/Inorganics (mg/L)							
Barium	6 / 6	NA	0.050 - 0.29	0.12	0.13	0.28	0.28
Chromium	4 / 6	0.010 - 0.010	0.010 - 0.030	0.018	0.014	0.040	0.030
Copper	2 / 6	0.020 - 0.020	0.020 - 0.020	0.020	0.013	0.020	0.020
Cyanide	1 / 6	0.020 - 0.020	0.050	0.050	0.016	0.040	0.040
Nickel	3 / 6	0.020 - 0.020	0.020 - 0.040	0.027	0.019	0.038	0.038
Zinc	5 / 6	0.020 - 0.020	0.050 - 0.11	0.084	0.085	0.40	0.11

EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/L	Micrograms per liter.
mg/L	Milligrams per liter.
NA	Not available.
SQLs	Practical sample quantitation limits for the non-detects.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs	Volatile organic compounds.

TABLE 5-4
OCCURRENCE SUMMARY FOR SURFICIAL SOIL SAMPLES FROM SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max		Range of Detects Min – Max	Average Detect	Mean	UCL	TEF	EPC	Bkgd
VOCs (µg/kg)										
Acetone	1 / 15	57 - 93		150	150	40	50	NAP	50	
SVOCs (µg/kg)										
Acenaphthene	1 / 15	380 - 920	*	460	460	250	290	NAP	290	
Acenaphthylene	5 / 15	400 - 460		568 - 9,400	2,500	690	1,600	NAP	1,600	
Anthracene	4 / 15	400 - 610		410 - 10,000	3,000	620	1,400	NAP	1,400	
Benzo(a)anthracene	8 / 15	400 - 460		590 - 63,000	9,700	2,900	16,000	0.1	1,600	
Benzo(b)fluoranthene	6 / 15	400 - 460		540 - 33,000	6,900	1,700	7,200	0.1	720	
Benzo(k)fluoranthene	7 / 15	400 - 460		500 - 16,000	3,200	1,100	3,100	0.01	31	
Benzo(g,h,i)perylene	6 / 15	400 - 460		720 - 22,000	5,300	1,700	6,400	NAP	6,400	
Benzo(a)pyrene	8 / 15	400 - 460		430 - 36,000	5,600	1,800	6,900	1.0	6,900	
Chrysene	7 / 15	400 - 610		470 - 39,000	6,800	1,700	7,000	0.001	7.0	
Dibenzo(a,h)anthracene	1 / 15	380 - 1,040	*	570	570	260	310	1.0	310	
Fluoranthene	7 / 15	400 - 610		690 - 46,000	8,200	2,400	11,000	NAP	11,000	
Fluorene	2 / 15	380 - 2,400	*	490 - 1,200	850	350	510	NAP	510	
Indeno(1,2,3-cd)pyrene	6 / 15	400 - 460		650 - 22,000	5,100	1,500	5,700	0.1	570	
Naphthalene	3 / 15	380 - 610		490 - 6,300	2,500	470	880	NAP	880	
Phenanthrene	5 / 15	400 - 610		500 - 14,000	4,000	1,100	3,100	NAP	3,100	
Pyrene	7 / 15	400 - 610		460 - 55,000	9,500	2,400	13,000	NAP	13,000	
Metals/Inorganics (mg/kg)										
Antimony	2 / 15	5.8 - 9.4		7.4 - 13	10	4.2	5.2	NAP	5.2	
Arsenic	15 / 15	NA		5.5 - 21	11	11	14	NAP	14	
Barium	15 / 15	NA		28 - 190	89	91	130	NAP	130	
Beryllium	5 / 15	0.58 - 0.94		1.2 - 2.1	1.5	0.73	1.2	NAP	1.2	
Cadmium	9 / 15	0.60 - 0.70		0.83 - 10	3.5	2.3	6.2	NAP	6.2	
Chromium	15 / 15	NA		8.1 - 162	35	33	59	NAP	59	
Copper	15 / 15	NA		10 - 92	33	33	52	NAP	52	

Footnotes on page 2.

TABLE 5-4
OCCURRENCE SUMMARY FOR SURFICIAL SOIL SAMPLES FROM SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	TEF	EPC	Bkgd
Metals/Inorganics (mg/kg)									
Cyanide	14 / 15	0.30	0.70 - 5.6	2.1	2.2	4.1	NAP	4.1	
Lead	14 / 15	3.5	13 - 300	91	110	380	NAP	300	
Mercury	4 / 15	0.29 - 0.36	0.35 - 0.63	0.50	0.25	0.34	NAP	0.34	
Nickel	15 / 15	NA	5.0 - 45	19	20	30	NAP	30	
Silver	4 / 15	1.2 - 1.9	1.6 - 3.2	2.4	1.1	1.6	NAP	1.6	
Zinc	15 / 15	NA	25 - 2,200	630	770	2,500	NAP	2,200	

*	When SQL/2 exceeds the maximum detect (i.e., an unusually high SQL), the maximum detect is used as the proxy concentration.
EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
SQLs	Practical sample quantitation limits for the non-detects.
SVOCs	Semivolatile organic compounds.
TEF	Toxic equivalency factor for carcinogenic PAHs.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs	Volatile organic compounds.

TABLE 5-5
OCCURRENCE SUMMARY FOR SLUDGE SAMPLES FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	EPC
Metals/Inorganics							
Antimony	4 / 4	NA	15 - 18	17	17	19	18
Arsenic	4 / 4	NA	15 - 18	16	16	18	18
Barium	4 / 4	NA	200 - 240	230	230	250	240
Beryllium	4 / 4	NA	2.4 - 3.1	2.7	2.7	3.1	3.1
Cadmium	4 / 4	NA	7.9 - 11	9.0	9.0	11	11
Chromium	4 / 4	NA	50 - 180	130	140	530	180
Copper	4 / 4	NA	85 - 130	100	100	140	130
Cyanide	4 / 4	NA	2.4 - 4.7	3.5	3.6	5.6	4.7
Lead	4 / 4	NA	240 - 1,703	700	750	13,000	1,700
Nickel	4 / 4	NA	33 - 43	39	39	46	43
Silver	4 / 4	NA	2.8 - 6.1	4.2	4.2	8.4	6.1
Zinc	4 / 4	NA	2,300 - 4,500	3,200	3,200	5,000	4,500

All concentrations are reported in milligrams per kilogram (mg/kg).

EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
NA	Not available.
SQLs	Practical sample quantitation limits for the non-detects.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.

TABLE 5-6
OCCURRENCE SUMMARY FOR SUBSURFACE SOIL SAMPLES FROM SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	EPC
VOCs (µg/kg)							
Toluene	1 / 17	6.0 - 7.0	8.0	8.0	3.6	4.0	4.0
Metals/Inorganics (mg/kg)							
Antimony	1 / 17	5.9 - 7.6	9.6	9.6	3.6	4.1	4.1
Arsenic	15 / 17	1.3 - 1.3	1.8 - 5.2	3.5	3.3	4.8	4.8
Barium	17 / 17	NA	2.4 - 420	110	150	400	400
Beryllium	2 / 17	0.60 - 0.80	1.9 - 2.8	2.4	0.52	0.74	0.74
Chromium	17 / 17	NA	2.4 - 19	10	11	14	14
Copper	9 / 17	2.3 - 3.0	4.3 - 110	20	9.1	25	25
Cyanide	2 / 19	0.20 - 0.30	0.70 - 1.3	0.98	0.20	0.28	0.28
Lead	11 / 17	2.9 - 3.8	5.0 - 36	12	9.0	18	18
Nickel	12 / 17	2.3 - 2.7	3.0 - 32	14	12	29	29
Silver	1 / 17	1.2 - 1.5	7.6	7.6	0.90	1.2	1.2
Zinc	17 / 17	NA	10 - 190	60	62	91	91

EPC Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NA Not available.
SQLs Practical sample quantitation limits for the non-detects.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs Volatile organic compounds.

TABLE 5-7
OCCURRENCE SUMMARY FOR SLUDGE SAMPLES FROM SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	TEF	EPC
PAHs (µg/kg)								
Benzo(k)fluoranthene	1 / 4	370 - 410	630	630	310	1,300	0.01	6.3
Metals/Inorganics (mg/kg)								
Antimony	4 / 4	NA	11 - 15	13	13	15	NAP	15
Arsenic	4 / 4	NA	3.8 - 8.8	7.0	7.1	14	NAP	8.8
Barium	4 / 4	NA	85 - 260	190	200	600	NAP	260
Beryllium	2 / 4	0.60	1.6 - 2.3	2.0	1.4	120	NAP	2.3
Cadmium	4 / 4	NA	5.0 - 12	8.6	8.8	20	NAP	12
Copper	3 / 4	2.5	7.2 - 160	96	310	2.4E+11	NAP	160
Cyanide	3 / 4	0.20	3.2 - 8.3	5.4	14	5.1E+07	NAP	8.3
Lead	4 / 4	NA	30 - 320	220	310	43,000	NAP	320
Nickel	4 / 4	NA	9.6 - 25	17	17	41	NAP	25
Silver	2 / 4	1.2 - 1.3	3.4 - 4.6	4.0	2.8	230	NAP	4.6
Zinc	4 / 4	NA	600 - 3,100	2,000	2,200	22,000	NAP	3,100

EPC	Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean	Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
PAHs	Polycyclic aromatic hydrocarbons.
SQLs	Practical sample quantitation limits for the non-detects.
TEF	Toxic equivalency factor for carcinogenic PAHs.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.

TABLE 5-8
OCCURRENCE SUMMARY FOR GROUNDWATER SAMPLES FROM SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Frequency Detects / Total	Range of SQLs Min – Max	Range of Detects Min – Max	Average Detect	Mean	UCL	EPC
VOCs (µg/L)							
Acetone	5 / 16	50 - 50	66 - 1,000	290	78	160	160
Benzene	3 / 16	5.0 - 5.0	6.0 - 14	11	3.9	5.4	5.4
Ethylbenzene	1 / 2	5.0	5.0	5.0	4.0	#N/A	5.0
Toluene	2 / 16	2.0 - 2.0	26	17.0	2.1	3.9	3.9
Trichloroethene	1 / 16	2.0 - 5.0	3.0	3.0	1.2	1.4	1.4
Xylenes	3 / 16	5.0 - 5.0	7.0 - 29	20	5.0	8.3	8.3
Metals/Inorganics (mg/L)							
Barium	14 / 14	NA	0.020 - 0.51	0.15	0.16	0.37	0.37
Chromium	3 / 14	0.010 - 0.010	0.010 - 0.020	0.013	0.0067	0.0084	0.0084
Copper	2 / 14	0.020 - 0.020	0.020 - 0.030	0.025	0.012	0.014	0.014
Cyanide	7 / 16	0.020 - 0.020	0.030 - 0.38	0.2	0.099	0.39	0.38
Lead	1 / 14	0.025 - 0.025	0.040	0.040	0.014	0.017	0.017
Silver	1 / 14	0.010 - 0.010	0.24	0.24	0.011	0.026	0.026
Zinc	6 / 14	0.020 - 0.020	0.050 - 0.21	0.13	0.061	0.19	0.19

EPC — Exposure point concentration; lesser of the UCL and the maximum detected concentration.
Mean — Arithmetic average of the total number of samples, using proxy concentrations for non-detects.
µg/L — Micrograms per liter.
mg/L — Milligrams per liter.
NA — Not available.
SQLs — Practical sample quantitation limits for the non-detects.
UCL — 95 percent upper confidence limit (one-tailed) on the mean, assuming a log-normal distribution.
VOCs — Volatile organic compounds.

TABLE 5-9
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN THE SUBSURFACE SOIL FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Industrial Risk-Based Screening Value		COC?	COC Basis
VOC (µg/kg)						
Acetone	110	NAP	20,000,000		no	B
Inorganics (mg/kg)						
Arsenic	30	11	3.8		YES	A
Barium	180	52	14,000		no	B
Beryllium	0.70	0.58	410		no	B
Cadmium	2.5	NAP	100		no	B
Chromium	19	30	610		no	B
Copper	22	8.3	8,200		no	B
Cyanide	0.43	NAP	4,100		no	B
Lead	19	12	400	[a]	no	B
Nickel	66	8.1	4,100		no	B
Zinc	430	31	61,000		no	B

[a] The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.

A Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).

COC Constituent of concern.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NAP Not applicable.
SWMU Solid waste management unit.
VOC Volatile organic compound.

TABLE 5-10
SELECTION OF CONSTITUTENTS OF POTENTIAL CONCERN IN SLUDGE FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Residential Risk-Based Screening Value		COC?	COC Basis
Carcinogenic PAHs (µg/kg)						
Benzo(a)anthracene	45,000	NAP	870		YES	A, C
Benzo(b)fluoranthene	57,000	NAP	870		YES	A, C
Benzo(k)fluoranthene	27,000	NAP	8,700		YES	A, C
Benzo(a)pyrene	47,000	NAP	87		YES	A, C
Chrysene	39,000	NAP	87,000		YES	C
Dibenzo(a,h)anthracene	3,200	NAP	87		YES	A, C
Indeno(1,2,3-cd)pyrene	39,000	NAP	870		YES	A, C
Non-Carcinogenic PAHs (µg/kg)						
Acenaphthylene	11,000	NAP	160,000	[a]	no	B
Anthracene	3,800	NAP	2,300,000		no	B
Benzo(g,h,i)perylene	40,000	NAP	160,000	[a]	no	B
Fluoranthene	25,000	NAP	310,000		no	B
Fluorene	5,400	NAP	310,000		no	B
Naphthalene	4,100	NAP	160,000		no	B
Phenanthrene	14,000	NAP	160,000	[a]	no	B
Pyrene	31,000	NAP	230,000		no	B
VOCs (µg/kg)						
2-Butanone (MEK)	530	NAP	4,700,000		no	B
Acetone	1,200	NAP	780,000		no	B
Ethylbenzene	220	NAP	780,000		no	B
Toluene	5,100	NAP	1,600,000		no	B
Xylenes	900	NAP	16,000,000		no	B
SVOCs (µg/kg)						
4-Methylphenol	10,000	NAP	39,000		no	B
Inorganics (mg/kg)						
Arsenic	42	11	0.43		YES	A
Barium	450	52	550		no	B
Chromium	190	30	23	[b]	YES	A
Copper	240	8.3	310		no	B
Cyanide	136	NAP	160		no	B
Lead	51	12	400	[c]	no	B
Mercury	8.6	0.034	0.78	[d]	YES	A
Nickel	270	8.1	160		YES	A
Selenium	150	NAP	39		YES	A
Silver	8.0	NAP	39		no	B
Zinc	300	31	2,300		no	B

Footnotes appear on page 2.

TABLE 5-10
SELECTION OF CONSTITUTENTS OF POTENTIAL CONCERN IN SLUDGE FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

[a]	The risk-based screening value for naphthalene is used as a surrogate.
[b]	The risk-based screening value for hexavalent chromium is reported.
[c]	The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.
[d]	The risk-based screening value for methylmercury is reported.
A	Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
B	Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
C	The constituent is a member of a chemical class which contains other COCs.
COC	Constituent of potential concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NAP	Not applicable.
PAHs	Polycyclic aromatic hydrocarbons.
SWMU	Solid waste management unit.
SVOCs	Semivolatile organic compounds.
VOCs	Volatile organic compounds.

TABLE 5-11
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN SURFICIAL SOILS FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Residential Risk-Based Screening Value		COC?	COC Basis
Carcinogenic PAHs (µg/kg)						
Benzo(a)anthracene	63,000	NAP	870		YES	A, C
Benzo(b)fluoranthene	33,000	NAP	870		YES	A, C
Benzo(k)fluoranthene	16,000	NAP	8,700		YES	A, C
Benzo(a)pyrene	36,000	NAP	87		YES	A, C
Chrysene	39,000	NAP	87,000		YES	C
Dibenzo(a,h)anthracene	570	NAP	87		YES	A, C
Indeno(1,2,3-cd)pyrene	22,000	NAP	870		YES	A, C
Non-Carcinogenic PAHs (µg/kg)						
Acenaphthene	460	NAP	470,000		no	B
Acenaphthylene	9,400	NAP	160,000	[a]	no	B
Anthracene	10,000	NAP	2,300,000		no	B
Benzo(g,h,i)perylene	22,000	NAP	160,000	[a]	no	B
Fluoranthene	46,000	NAP	310,000		no	B
Fluorene	1,200	NAP	310,000		no	B
Naphthalene	6,300	NAP	160,000		no	B
Phenanthrene	14,000	NAP	160,000	[a]	no	B
Pyrene	55,000	NAP	230,000		no	B
VOC (µg/kg)						
Acetone	150	NAP	780,000		no	B
Inorganics (mg/kg)						
Antimony	13	NAP	3.1		YES	A
Arsenic	21	11	0.43		no	D
Barium	190	52	550		no	B
Beryllium	2.1	0.58	16		no	B
Cadmium	10	NAP	3.9		YES	A
Chromium	162	30	23	[b]	YES	A
Copper	92	8.3	310		no	B
Cyanide	5.6	NAP	160		no	B
Lead	300	12	400	[c]	no	B
Mercury	0.63	0.034	0.78	[d]	no	B
Nickel	45	8.1	160		no	B
Silver	3.2	NAP	39		no	B
Zinc	2,200	31	2,300		no	B

Footnotes appear on page 2.

TABLE 5-11
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN SURFICIAL SOILS FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

[a]	The risk-based screening value for naphthalene is used as a surrogate.
[b]	The risk-based screening value for hexavalent chromium is reported.
[c]	The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.
[d]	The risk-based screening value for methylmercury is reported.
A	Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
B	Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
C	The constituent is a member of a chemical class which contains other COCs.
D	Less than 2 times background concentration.
COC	Constituent of potential concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NAP	Not applicable.
PAHs	Polycyclic aromatic hydrocarbons.
SWMU	Solid waste management unit.
VOC	Volatile organic compound.

TABLE 5-12
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN SLUDGE FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Residential Risk-Based Screening Value		COC?	COC Basis
Inorganics						
Antimony	18	NAP	3.1		YES	A
Arsenic	18	11	0.43		no	C
Barium	240	52	550		no	B
Beryllium	3.1	0.58	16		no	B
Cadmium	11	NAP	3.9		YES	A
Chromium	180	30	23	[a]	YES	A
Copper	130	8.3	310		no	B
Cyanide	4.7	NAP	160		no	B
Lead	1,703	12	400	[b]	YES	A
Nickel	43	8.1	160		no	B
Silver	6.1	NAP	39		no	B
Zinc	4,500	31	2,300		YES	A

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] The risk-based screening value for hexavalent chromium is reported.
[b] The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.

A Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
C Less than 2 times background concentration.

COC Constituent of potential concern.
NAP Not applicable; constituent was not detected in background samples.

TABLE 5-13
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
IN SUBSURFACE SOIL FOR SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Industrial Risk-Based Screening Value		COC?	COC Basis
VOC (µg/kg)						
Toluene	8.0	NAP	41,000,000		no	B
Inorganics (mg/kg)						
Antimony	9.6	NAP	82		no	B
Arsenic	5.2	11	3.8		no	A
Barium	420	52	14,000		no	B
Beryllium	2.8	0.58	410		no	B
Chromium	19	30	610	[a]	no	B
Copper	110	8.3	8,200		no	B
Cyanide	1.3	NAP	4,100		no	B
Lead	36	12	400	[b]	no	B
Nickel	32	8.1	4,100		no	B
Silver	7.6	NAP	1,000		no	B
Zinc	190	31	61,000		no	B

[a] The risk-based screening value for hexavalent chromium is reported.
[b] The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.

A Less than 2 times background concentration.
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).

COC Constituent of potential concern.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NAP Not applicable.
SWMUs Solid waste management units.
VOC Volatile organic compound.

TABLE 5-14
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN SLUDGE FOR SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Background Concentration	Residential Risk-Based Screening Value		COC?	COC Basis
Carcinogenic PAHs (µg/kg)						
Benzo(k)fluoranthene	630	NAP	8,700		no	B
Inorganics (mg/kg)						
Antimony	15	NAP	3.1		YES	A
Arsenic	8.8	11	0.43		no	D
Barium	260	52	550		no	B
Beryllium	2.3	0.58	16		no	B
Cadmium	12	NAP	3.9		YES	A
Copper	160	8.3	310		no	B
Cyanide	8.3	NAP	160		no	B
Lead	320	12	400	[a]	no	B
Nickel	25	8.1	160		no	B
Silver	4.6	NAP	39		no	B
Zinc	3,100	31	2,300		YES	A

[a] The USEPA Office of Solid Waste recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.

A Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogens).
C The constituent is a member of a chemical class which contains other COCs.
D Maximum detected concentration is less than 2 times background concentration.

COC Constituent of potential concern.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NAP Not applicable.
PAHs Polycyclic aromatic hydrocarbons.
SWMU Solid waste management unit.

TABLE 5-15
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN GROUNDWATER FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Residential Risk-Based Screening Value	COC?		Basis
VOC (μg/L)					
Acetone	110	61	YES		A
Metals (mg/L)					
Barium	0.29	0.26	YES		A
Chromium	0.030	0.011	YES	[a]	A
Copper	0.020	0.15	no		B
Cyanide	0.050	0.073	no		B
Nickel	0.040	0.073	no		B
Zinc	0.11	1.1	no		B

[a] The risk-based screening value for hexavalent chromium is reported.

A Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcino
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carcinogen

COC Constituent of potential concern.
μg/L Micrograms per liter.
mg/L Milligrams per liter.
SWMU Solid waste management unit.
VOC Volatile organic compound.

TABLE 5-16
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN IN GROUNDWATER FOR SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Maximum Concentration	Residential Risk-Based Screening Value	COC?		COC Basis
VOCs (µg/L)					
Acetone	1,000	61	YES		A
Benzene	14	0.36	YES		A
Ethylbenzene	5.0	130	no		B
Toluene	26	75	no		B
Trichloroethene	3.0	1.6	YES		A
Xylenes	29	1,200	no		B
Metals (mg/L)					
Barium	0.51	0.26	YES		A
Chromium	0.020	0.01	YES	[a]	A
Copper	0.030	0.15	no		B
Cyanide	0.38	0.073	YES		A
Lead	0.040	0.015	YES	[b]	A
Silver	0.24	0.018	YES		A
Zinc	0.21	1.1	no		B

[a] The risk-based screening value for hexavalent chromium is reported.
[b] The drinking water action level is listed as the screening value.

A Greater than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-ca
B Less than risk-based concentration (10-6 for carcinogens and HQ=0.1 for non-carci
C The constituent is a member of a chemical class which contains other COCs.

COC Constituent of potential concern.
µg/L Micrograms per liter.
mg/L Milligrams per liter.
SWMUs Solid waste management units.
VOCs Volatile organic compounds.

TABLE 5-17
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT BY MEDIUM
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

	Surficial Soil	Subsurface Soil		Sludge			Groundwater	
Constituents	SWMU 24	SWMU 23	SWMUs 38 & 39	SWMU 23	SWMU 24	SWMU 39	SWMU 23	SWMUs 38 & 39
VOCs								
Acetone							X	X
Benzene								X
Trichloroethene								X
PAHs								
Benzo(a)anthracene	X			X				
Benzo(b)fluoranthene	X			X				
Benzo(k)fluoranthene	X			X				
Benzo(a)pyrene	X			X				
Chrysene	X			X				
Dibenzo(a,h)anthracene	X			X				
Indeno(1,2,3-cd)pyrene	X			X				
Inorganics								
Antimony	X				X	X		
Arsenic		X		X				
Barium							X	X
Cadmium	X				X	X		
Chromium	X			X	X		X	X
Cyanide								X
Lead					X			X
Mercury				X				
Nickel				X				
Selenium				X				
Silver								X
Zinc					X	X		

PAHs Polycyclic aromatic hydrocarbons.
SWMU Solid waste management unit.
VOCs Volatile organic compounds.

TABLE 5-18
ORAL REFERENCE DOSES, INHALATION REFERENCE CONCENTRATIONS, TARGET SITES, AND CONFIDENCE LEVELS FOR CONSTITUENTS OF CONCERN
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RfDo (mg/kg/day) Subchronic	RfDo (mg/kg/day) Chronic	RfC (mg/m³) Subchronic	RfC (mg/m³) Chronic	Target Sites Oral	Target Sites Inhalation	Confidence Level/ Uncertainty Factor Oral	Confidence Level/ Uncertainty Factor Inhalation
VOCs								
Acetone	1.0E+00	1.0E-01	NA	NA	liver, kidney	NA	low/1000	NA
Benzene	NA	3.0E-03	6.0E-02	6.0E-03	NA	hematological	NA	NA
Trichloroethene	6.0E-03	6.0E-03	NA	NA	liver	NA	low/3000	NA
PAHs*								
Benzo(a)anthracene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Benzo(b)fluoranthene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Benzo(k)fluoranthene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Benzo(a)pyrene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Chrysene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Dibenz(a,h)anthracene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Indeno(1,2,3-c,d)pyrene	3.0E-01	3.0E-02	NA	NA	kidney	NA	low/3000	NA
Inorganics								
Antimony	4.0E-04	4.0E-04	NA	NA	increased mortality	NA	low/1000	NA
Arsenic	3.0E-04	3.0E-04	NA	NA	skin	NA	medium/3	NA
Barium	7.0E-02	7.0E-02	5.0E-03	5.0E-04	increased blood pressure	fetotoxicity	medium/3	NA/1000
Cadmium (food)**	NA	1.0E-03	NA	NA	kidney	NA	high/10	NA
Chromium VI	2.0E-02	3.0E-03	NA	1.0E-04	NR	nasal/lung	low/300	medium/300
Cyanide	2.0E-02	2.0E-02	NA	NA	thyroid	NA	medium/100	NA
Lead	NA	NA	NA	NA	CNS	CNS	NA	NA
Mercury	NA	NA	3.0E-04	3.0E-04	kidney	CNS	NA	medium/30
Nickel	2.0E-02	2.0E-02	NA	NA	decreased body weight	NA	medium/300	NA
Selenium	5.0E-03	5.0E-03	NA	NA	selenosis	NA	medium/3	NA
Silver	5.0E-03	5.0E-03	NA	NA	argyria	NA	low/3	NA
Zinc	3.0E-01	3.0E-01	NA	NA	anemia	NA	medium/3	NA

References: IRIS, 2000; USEPA, 1997b; USEPA, 1999.

* Toxicity values are not available. Pyrene used as a surrogate for non-cancer effects.
** The RfD for food is used to assess soil exposure.

CNS	Central nervous system.
GI	Gastrointestinal.
mg/kg/day	Milligrams per kilogram per day.
mg/m³	Milligrams per cubic meter.
NA	Not available.
NR	None reported.
PAHs	Polycyclic aromatic hydrocarbons.
RfC	Reference concentration.
RfDo	Oral reference dose.

TABLE 5-19
ORAL AND INHALATION CANCER SLOPE FACTORS, TUMOR SITES, AND USEPA CANCER CLASSIFICATIONS FOR CONSTITUENTS OF CONCERN
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Oral CSF (kg-day/mg)	TEF	Inhalation Unit Risk ($m^3/\mu g$)	Tumor site		USEPA Classification
				Oral	Inhalation	
VOCs						
Benzene	1.5E-02 - 5.5E-02	NAP	2.2E-06 - 7.8E-06	leukemia	leukemia	A
Trichloroethene	1.1E-02	NAP	1.7E-06	liver	lung	C-B2
PAHs*						
Benzo(a)anthracene	7.3E+00	0.1	8.8E-04	stomach	respiratory tract	B2
Benzo(b)fluoranthene	7.3E+00	0.1	8.8E-04	stomach	respiratory tract	B2
Benzo(k)fluoranthene	7.3E+00	0.01	8.8E-04	stomach	respiratory tract	B2
Benzo(a)pyrene	7.3E+00	1.0	8.8E-04	stomach	respiratory tract	B2
Chrysene	7.3E+00	0.001	8.8E-04	stomach	respiratory tract	B2
Dibenz(a,h)anthracene	7.3E+00	1.0	8.8E-04	stomach	respiratory tract	B2
Indeno(1,2,3-c,d)pyrene	7.3E+00	0.1	8.8E-04	stomach	respiratory tract	B2
Inorganics						
Arsenic	1.5E+00	NAP	4.3E-03	skin	respiratory tract	A
Cadmium	NAP	NAP	1.8E-03	NA	respiratory tract	B1
Chromium VI	NAP	NAP	1.2E-02	NA	lung	A
Lead	NA	NAP	NA	NA	NA	B2
Nickel (refinery dust)	NAP	NAP	2.4E-04	NA	respiratory tract	A

References: IRIS, 2000; USEPA, 1997a.

* Benzo(a)pyrene used as a surrogate for carcinogenic PAHs. The exposure point concentration is multiplied by the TEF and the benzo(a)py

A Known human carcinogen.
B1 Probable human carcinogen; limited evidence in humans.
B2 Probable human carcinogen; sufficient evidence in animals and inadequate data in humans.
C Possible human carcinogen.
CSF Cancer slope factor.
kg-day/mg Kilograms-day per milligram.

NA Not available.
NAP Not applicable.
PAHs Polycyclic aromatic hydrocarbons.
TEF Toxicity equivalency factor.
VOC Volatile organic compounds.

TABLE 5-20
DERMAL AND ORAL ABSORPTION EFFICIENCIES
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituents	Absorption Efficiency Dermal		Absorption Efficiency Oral	
VOCs	0.1	a	1.00	b
PAHs	0.03	c	0.85	c
Inorganics				
Antimony	0.001	a	0.01	c
Arsenic	0.001	a	0.95	c
Barium	0.001	a	0.07	c
Cadmium	0.018	c	0.02	c
Chromium	0.001	a	0.02	c
Cyanide	0.001	a	0.72	c
Lead	0.0006	c	0.15	c
Mercury	0.026	c	0.15	c
Nickel	0.0023	c	0.043	c
Selenium	0.001	a	0.97	c
Silver	0.001	a	0.21	c
Zinc	0.001	a	0.30	c

a USEPA, 1996a.
b Assumed.
c ATSDR, 1997.
NAP Not applicable.
PAHs Polycyclic aromatic hydrocarbons.
VOCs Volatile organic compounds.

TABLE 5-21
ADJUSTED TOXICITY VALUES USED TO ASSESS DERMAL EXPOSURE FOR CONSTITUENTS OF CONCERN
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RfDo (mg/kg/day) Subchronic	RfDo (mg/kg/day) Chronic	CSFo (kg-day/mg)	Oral Absorption Efficiency		RfDa (mg/kg/day) Subchronic	RfDa (mg/kg/day) Chronic	CSFa (kg-day/mg)
VOCs								
Acetone	1.0E+00	1.0E-01	NC	1.00	[a]	1.0E+00	1.0E-01	NC
Benzene	NA	3.0E-03	5.5E-02	1.00	[a]	NA	3.0E-03	5.5E-02
Trichloroethene	6.0E-03	6.0E-03	1.1E-02	1.00	[a]	6.0E-03	6.0E-03	1.1E-02
PAHs								
Benzo(a)anthracene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Benzo(b)fluoranthene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Benzo(k)fluoranthene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Benzo(a)pyrene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Chrysene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Dibenzo(a,h)anthracene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Indeno(1,2,3-c,d)pyrene	3.0E-01	3.0E-02	7.3E+00	0.85	[b]	2.6E-01	2.6E-02	8.6E+00
Inorganics								
Antimony	4.0E-04	4.0E-04	NC	0.01	[b]	4.0E-06	4.0E-06	NC
Arsenic	3.0E-04	3.0E-04	1.5E+00	0.95	[b]	2.9E-04	2.9E-04	1.6E+00
Barium	7.0E-02	7.0E-02	NC	0.07	[b]	4.9E-03	4.9E-03	NC
Cadmium (food)	NA	1.0E-03	NAP	0.02	[b]	NA	2.0E-05	NAP
Chromium VI	2.0E-02	3.0E-03	NAP	0.02	[b]	4.0E-04	6.0E-05	NAP
Cyanide	2.0E-02	2.0E-02	NC	0.72	[b]	1.4E-02	1.4E-02	NC
Lead	NA	NA	NA	0.15	[b]	NA	NA	NA
Mercury	NA	NA	NC	0.15	[b]	NA	NA	NC
Nickel	2.0E-02	2.0E-02	NAP	0.043	[b]	8.6E-04	8.6E-04	NAP
Selenium	5.0E-03	5.0E-03	NC	0.97	[b]	4.9E-03	4.9E-03	NC
Silver	5.0E-03	5.0E-03	NC	0.21	[b]	1.1E-03	1.1E-03	NC
Zinc	3.0E-01	3.0E-01	NC	0.30	[b]	9.0E-02	9.0E-02	NC

Footnotes appear on page 2.

TABLE 5-21
ADJUSTED TOXICITY VALUES USED TO ASSESS DERMAL EXPOSURE FOR CONSTITUENTS OF CONCERN
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

[a]	Assumed.
[b]	ATSDR, 1996.
CSF	Cancer slope factor (CSFo = oral; CSFa = adjusted for dermal exposure).
kg-day/mg	Kilograms-day per milligram.
mg/kg/day	Milligrams per kilogram per day.
NA	Not available.
NAP	Not applicable.
NC	Not evaluated as a carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.
RfD	Reference dose (RfDo = oral; RfDa = adjusted for dermal exposure).

TABLE 5-22
PERMEABILITY COEFFICIENTS FOR CONSTITUENTS OF CONCERN IN GROUNDWATER
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Permeability Coefficient (cm/hr)	[ref]
VOCs		
Acetone	5.7E-04	[a]
Benzene	2.1E-02	[b]
Trichloroethene	1.6E-02	[b]
Inorganics		
Barium	1.6E-04	[c]
Chromium	1.6E-04	[c]
Cyanide	1.6E-04	[c]
Lead	4.0E-06	[d]
Silver	1.6E-04	[c]

[a] Calculated using the adjusted Bronaugh equation.
[b] USEPA, 1992c.
[c] Assumed equal to the permeability coefficient for water (USEPA, 199
[d] ATSDR (1991e).

cm/hr Centimeters per hour.
ref Reference
VOCs Volatile organic compounds.

TABLE 5-23
PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC CONSTITUENTS OF CONCERN
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)
VOCs							
Acetone	58	miscible	0.79	270	3.97E-05	0.11498	0.37
Benzene	78	1,780	0.88	95	5.48E-03	0.09320	49 - 100
Trichloroethene	131	1,100 - 1,500	1.46	73	9.90E-03	0.08116	65 -126
PAHs							
Benzo(a)anthracene	228	0.0094 - 0.014	1.27	1.1E-07	8.00E-06	0.04564	1,400,000
Benzo(b)fluoranthene	252	0.0012	NA	5.0E-07	1.20E-05	0.04392	550,000
Benzo(k)fluoranthene	252	0.00055	NA	9.59E-11	4.20E-08	0.04392	4,400,000
Benzo(a)pyrene	252	0.0038 - 0.004	1.35	5.49E-09	< 2.4E-06	0.04653	398,000 - 1,900,000
Chrysene	228	0.0018 - 0.006	1.27	6.3E-09	3.15E-07	0.04531	240,000
Dibenzo(a,h)anthracene	278	0.00249 - 0.005	1.28	~10E-10 (20 °C)	7.33E-09	0.05707	1,700,000
Indeno(1,2,3-c,d)pyrene	276	0.062	NA	1.0E-09	2.96E-20	0.05728	31,000,000

References: Lyman et al., 1990; Montgomery and Welkom, 1990; HSDB 2000.

atm-m³/mol	Atmospheres-cubic meters per mole.	mg/L	Milligrams per liter.
°C	Degrees Celsius.	mm Hg	Millimeters of mercury.
cm²/sec	Square centimeters per second.	NA	Not available.
g/mol	Grams per mole.	PAHs	Polycyclic aromatic hydrocarbons.
Koc	Organic carbon partition coefficient.	VOCs	Volatile organic compounds.
mL/g	Milliliters per gram.		

TABLE 5-24
RECEPTOR-SPECIFIC EXPOSURE PARAMETERS
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Parameter	(units)	Site Worker SWMU 23	Site Worker SWMU 24	Site Worker SWMU 38 & 39	Resident SWMU 23 SWMU 38 & 39	Construction Worker SWMU 23 SWMU 38 & 39	Trespasser (Age 7 - 16 years) SWMU 23, SWMU 24 SWMU 38 & 39
APc	(days)	25,550	25,550	25,550	25,550	25,550	25,550
APnc	(days)	9,125	9,125	9,125	10,950	365	3,650
BW	(kg)	70	70	70	70	70	42
EF	(days/year)	12	250	250	350	90	24
EP	(years)	25	25	25	30	1	10
ET	(hours/day)	2	8	8	0.58 [a]	1 [b]	1
IR_A	(m^3/day)	5	20	20	15	20	2.5 [c]
IR_S	(mg/day)	50	50	50	NAP	480	50
IR_W	(L/day)	1	NAP	1	2	0.01	NAP
SAR	(mg/cm^2/day)	0.0152	0.0152	0.0152	NAP	0.367	0.157
SSA	(cm^2)	3,160	3,160	3,160	18,000	3,160	4,000

References: USEPA (1989, 1996a, 1997, 1999); professional judgement.

[a] Exposure time for dermal exposure while showering/bathing.
[b] Exposure time for dermal contact with ponded water.
[c] Inhalation rate calculated as 1.5 m^3/day (USEPA, 1997) × (70 kg/42 kg) to correct for 70-kg body weight assumed in the inhalation toxicity values.

APc	Averaging period for cancer risk.	IR_W	Ingestion rate of groundwater.
APnc	Averaging period for non-cancer risk.	kg	Kilogram.
BW	Body weight.	L	Liter.
cm^2	Square centimeters.	m^3	Cubic meter.
EF	Exposure frequency.	mg	Milligram.
EP	Exposure period.	NAP	Not applicable.
ET	Exposure time.	SAR	Soil adherence rate.
IR_A	Inhalation rate of air.	SSA	Exposed skin surface area.
IR_s	Incidental ingestion rate of soil.	SWMU	Solid waste management unit.

TABLE 5-25
RISK EQUATIONS FOR WORKER EXPOSURE TO SLUDGE, SURFICIAL AND SUBSURFACE SOIL
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

ROUTE-SPECIFIC RISKS:

Oral:

$$\begin{matrix}ELCR_o \text{ or} \\ HQ_o\end{matrix} = \frac{EPC_S \times IR_S \times EF \times EP}{UC_1 \times BW \times (AP_C \text{ or } AP_{NC}) \times [(1/CSF_0) \text{ or } RfD_0]}$$

Dermal:

$$\begin{matrix}ELCR_d \text{ or} \\ HQ_d\end{matrix} = \frac{EPC_S \times SSA \times SAR \times ABS \times EF \times EP}{UC_1 \times BW \times (AP_C \text{ or } AP_{NC}) \times [(1/CSF_a) \text{ or } RfD_a]}$$

Inhalation:

$$\begin{matrix}ELCR_i \text{ or} \\ HQ_i\end{matrix} = \frac{EPC_S \times [(1/VF) + (1/PEF)] \times IRC \times EF \times EP}{(AP_C \text{ or } AP_{NC}) \times [(UC_2 / UR_i) \text{ or } RfC]}$$

where:

$$VF = Q/C \times \frac{(3.1416 \times \alpha \times T)^{1/2}}{2 \times Dei \times Pa \times Kas} \times UC_3$$

$$PEF = Q/C \times \frac{3{,}600 \text{ sec/hr}}{RPF \times (1-G) \times (Um/Ut)^3 \times F_x}$$

$$\alpha = \frac{Dei \times Pa}{Pa + [\rho s \times (1 - Pa)/Kas]}$$

$$Dei = Di \times (Pa^{3.33} / Pt^2)$$

$$K_{as} = H / (RT \times K_d)$$

CANCER RISK:

$$ELCR = ELCR_o + ELCR_d + ELCR_i$$

NON-CANCER RISK:

$$HI = HQ_o + HQ_d + HQ_i$$

TABLE 5-25
RISK EQUATIONS FOR WORKER EXPOSURE TO SLUDGE, SURFICIAL AND SUBSURFACE SOIL
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

where:

a	Alpha; calculation intermediate (cm^2/sec).
ABS	Dermal absorption efficiency.
AP_C	Averaging period for cancer effects (25,550 days); 70 yrs × 365 days/year.
AP_{NC}	Averaging period for non-cancer effects (days); (EP × 365 days/year).
BW	Body weight (kg).
CSF	Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg; inverse of mg/kg/day).
Dei	Effective diffusivity (cm^2/sec).
Di	Diffusivity in air (cm^2/sec).
EF	Exposure frequency (days/year).
ELCR	Excess lifetime cancer risk (unitless).
EPCs	Exposure point concentration in soil (arithmetic average) (mg/kg).
EP	Exposure period (years).
ET	Exposure time (hours/day).
F_X	Function of Ut/Um (0.000152) (unitless); $F_X = 0.18 \times [8x^3 + 12x] \times \exp[-(x^2)]$, where $x = 0.886 \times (Ut/Um)$.
Foc	Fraction organic carbon in soil (0.02).
G	Fraction of vegetative cover (unitless); conservatively assumed as zero.
H	Henry's Law Constant (atm-m^3/mol).
HI	Hazard index (unitless); sum of the HQs.
HQ	Hazard quotient (unitless).
IR_A	Inhalation rate of air (m^3/day).
IRC	Inhalation rate correction factor, to correct for differences from the inhalation rate of 20 m^3/day assumed in the derivation of the inhalation toxicity values; calculated as IR_A/(20 m^3/day) (unitless).
IR_S	Ingestion rate of soil (mg/day).
Kas	Soil-air partition coefficient (g soil/cm^3 air).
Kd	Soil-water partition coefficient (cm^3/g or mL/g). Kd is calculated as Foc × Koc for organics.
Koc	Organic carbon partition coefficient (cm^3/g or mL/g); average of range in Table 5-20.
Pa	Air-filled soil porosity (0.20) (unitless).
PEF	Particulate emission factor (m^3/kg).
Pt	Total soil porosity (0.35) (unitless).
ρs	True soil or particle density (2.65 g/cm^3).
Q/C	Emission flux per unit concentration (75.0 g/m^2/sec)/(kg/m^3) (USEPA, 1996c).
RfC	Subchronic reference concentration for inhalation exposure (mg/m^3).
RfD	Subchronic reference dose for oral (RfD_o) or dermal (adjusted to an absorbed dose, RfD_a) intake (mg/kg/day).
RPF	Respirable particle fraction (0.036 g/m^2/hr) (USEPA, 1991a).
RT	Product of the ideal gas constant (8.206×10^{-5} atm-m^3/mol/K) and the Kelvin temperature (298 K at 25 °C) = 0.02445 atm-m^3/mol.
SAR	Soil adherence rate (mg/cm^2/day).
SSA	Exposed skin surface area (cm^2).
T	Exposure interval (7.9×10^8 sec).
UC_1	Unit conversion #1 (10^6 mg/kg).
UC_2	Unit conversion #2 (0.001 mg/μg).
UC_3	Unit conversion #3 (0.0001 m^2/cm^2).
Um	Wind speed (3.13 m/sec).
UR_i	Unit cancer risk for inhalation exposure (m^3/μg).
Ut	Equivalent threshold value of windspeed at 10 meters (12.8 m/sec).
VF	Volatilization factor (m^3/kg).

TABLE 5-25
RISK EQUATIONS FOR WORKER EXPOSURE TO SLUDGE, SURFICIAL AND SUBSURFACE SOIL
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

SAMPLE CALCULATION: Benzo(a)pyrene, Site Worker, SWMU 24 Surface Soil.

$$x = 0.886 \times \left[\left(12.8\ \mathrm{m/sec}\right) / \left(3.13\ \mathrm{m/sec}\right)\right] = 3.62$$

$$F_X = 0.18 \times \left[\left(8 \times 3.62^3\right) + \left(12 \times 3.62\right)\right] \times \exp\left[-\left(3.62^2\right)\right] = 0.000152$$

$$\mathrm{PEF} = \left[\frac{75.0\ \mathrm{g/m^2/sec}}{\mathrm{kg/m^3}}\right] \times \frac{(3{,}600\ \mathrm{sec/hr})}{(0.036\ \mathrm{g/m^2/hr}) \times (1-0) \times [(3.13\ \mathrm{m/sec})/(12.8\ \mathrm{m/sec})]^3 \times (0.000152)}$$
$$= 3.38 \times 10^{12}\ \mathrm{m^3/kg}$$

$$\mathrm{Kas} = \frac{(2.40 \times 10^{-6}\ \mathrm{atm-m^3/mol})}{(0.02445\ \mathrm{atm \cdot m^3/mol}) \times (1{,}149{,}000\ \mathrm{cm^3/g}) \times (0.02)} = 4.27 \times 10^{-9}\ \mathrm{g/cm^3}$$

$$\mathrm{Dei} = (0.04653\ \mathrm{cm^2/sec}) \times [(0.20)^{3.33} / (0.35)^2] = 0.001787\ \mathrm{cm^2/sec}$$

$$\alpha = \frac{(0.001787\ \mathrm{cm^2/sec}) \times 0.20}{0.20 + [(2.65\ \mathrm{g/cm^3}) \times (1-0.20) / (4.27 \times 10^{-9}\ \mathrm{g/cm^3})]} = 7.20 \times 10^{-13}\ \mathrm{cm^2/sec}$$

$$\mathrm{VF} = \frac{75.0\ \mathrm{g/m^2/sec}}{\mathrm{kg/m^3}} \times \frac{[3.1416 \times (7.20 \times 10^{-13}\ \mathrm{cm^2/sec}) \times (7.9 \times 10^8\ \mathrm{sec})]^{1/2}}{2 \times (0.001787\ \mathrm{cm^2/sec}) \times 0.20 \times (4.27 \times 10^{-9}\ \mathrm{g/cm^3})} \times (10^{-4}\ \mathrm{m^2/cm^2})$$
$$= 1.03 \times 10^8\ \mathrm{m^3/kg}$$

Cancer Risk:

$$\mathrm{ELCR_o} = \frac{(6.9\ \mathrm{mg/kg}) \times (50\ \mathrm{mg/day}) \times (250\ \mathrm{days/yr}) \times (25\ \mathrm{yrs})}{(10^6\ \mathrm{mg/kg}) \times (70\ \mathrm{kg}) \times (25{,}550\ \mathrm{days}) \times 1/(7.3\ \mathrm{kg \cdot day/mg})}$$
$$= 8.8 \times 10^{-6}$$

$$\mathrm{ELCR_d} = \frac{(6.9\ \mathrm{mg/kg}) \times (3{,}160\ \mathrm{cm^2}) \times (0.0152\ \mathrm{mg/cm^2/day}) \times (0.03) \times (250\ \mathrm{days/yr}) \times (25\ \mathrm{yrs})}{(10^6\ \mathrm{mg/kg}) \times (70\ \mathrm{kg}) \times (25{,}550\ \mathrm{days}) \times 1/(8.6\ \mathrm{kg \cdot day/mg})}$$
$$= 3.0 \times 10^{-7}$$

TABLE 5-25
RISK EQUATIONS FOR WORKER EXPOSURE TO SLUDGE, SURFICIAL AND SUBSURFACE SOIL
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

$$ELCR_i = \frac{(6.9 \text{ mg/kg}) \times [(1/1.03 \times 10^8 \text{ m}^3\text{/kg}) + (1/3.38 \times 10^{12} \text{ m}^3\text{/kg})] \times (1) \times (250 \text{ days/yr}) \times (25 \text{ yrs})}{(25{,}550 \text{ days}) \times [(0.001 \text{ mg}/\mu\text{g}) / (8.8 \times 10^{-4} \text{ m}^3/\mu\text{g})]}$$

$$= 1.4 \times 10^{-8}$$

$$ELCR = (8.8 \times 10^{-6}) + (3.0 \times 10^{-7}) + (1.4 \times 10^{-8}) = 9.1 \times 10^{-6}$$

Non-Cancer Risk:

$$HQ_o = \frac{(6.9 \text{ mg/kg}) \times (50 \text{ mg/day}) \times (250 \text{ days/yr}) \times (25\text{yrs})}{(10^6 \text{ mg/kg}) \times (70 \text{ kg}) \times (9{,}125 \text{ days}) \times (3.0 \times 10^{-2} \text{ mg/kg/day})}$$

$$= 1.1 \times 10^{-4}$$

$$HQ_d = \frac{(6.9 \text{ mg/kg}) \times (3{,}160 \text{ cm}^2) \times (0.0152 \text{ mg/cm}^2\text{/day}) \times (0.03) \times (250 \text{ days/yr}) \times (25 \text{ yrs})}{(10^6 \text{ mg/kg}) \times (70 \text{ kg}) \times (9{,}125 \text{ days}) \times (2.6 \times 10^{-2} \text{ mg/kg/day})}$$

$$= 3.7 \times 10^{-6}$$

$$HQ_i = \frac{(6.9 \text{ mg/kg}) \times [(1/1.03 \times 10^8 \text{ m}^3\text{/kg}) + (1/3.38 \times 10^{12} \text{ m}^3\text{/kg})] \times (1) \times (250 \text{ days/yr}) \times (25 \text{ yrs})}{(9{,}125 \text{ days}) \times NA}$$

$$= NA$$

$$HI = (1.1 \times 10^{-4}) + (3.7 \times 10^{-6}) + NA = 1.1 \times 10^{-4} = 0.00011$$

TABLE 5-26
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO SLUDGE FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs		CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
PAHs (µg/kg)			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Benzo(a)anthracene	4,500	*	2.8E-07	9.4E-09	6.9E-11	2.8E-07	3.5E-06	1.2E-07	NA	0.0000036
Benzo(b)fluoranthene	5,700	*	3.5E-07	1.2E-08	1.7E-10	3.6E-07	4.5E-06	1.5E-07	NA	0.0000046
Benzo(k)fluoranthene	270	*	1.7E-08	5.6E-10	1.7E-13	1.7E-08	2.1E-07	7.0E-09	NA	0.00000022
Benzo(a)pyrene	47,000	*	2.9E-06	9.8E-08	4.4E-10	3.0E-06	3.7E-05	1.2E-06	NA	0.000038
Chrysene	39	*	2.4E-09	8.1E-11	2.9E-13	2.5E-09	3.1E-08	1.0E-09	NA	0.000000032
Dibenzo(a,h)anthracene	3,200	*	2.0E-07	6.7E-09	1.5E-12	2.0E-07	2.5E-06	8.3E-08	NA	0.0000026
Indeno(1,2,3-cd)pyrene	3,900	*	2.4E-07	8.1E-09	3.0E-15	2.5E-07	3.1E-06	1.0E-07	NA	0.0000032
Inorganics (mg/kg)										
Arsenic	42	*	5.3E-07	5.4E-10	1.6E-13	5.3E-07	3.3E-03	3.3E-06	NA	0.0033
Chromium	190	*	NAP	NAP	2.0E-12	2.0E-12	1.5E-03	7.1E-05	4.6E-09	0.0016
Mercury	9	*	NC	NC	NC	NC	NA	NA	7.0E-11	7.0E-11
Nickel	270	*	NC	NC	5.6E-14	5.6E-14	3.2E-04	1.6E-05	NA	0.00033
Selenium	150	*	NC	NC	NC	NC	7.0E-04	6.9E-07	NA	0.00071
					TOTAL ELCR	**5E-06**			**TOTAL HI**	**0.006**

*	EPC is equal to the maximum detected concentration.
ELCR	Excess lifetime cancer risk.
EPCs	Exposure point concentration in sludge waste (Table 5-2).
HI	Hazard index.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
NC	Not a suspected carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.

TABLE 5-27
RISK CALCULATIONS FOR CONSTRUCTION WORKER EXPOSURE TO SUBSURFACE SOIL FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs (mg/kg)	CANCER RISK				NON-CANCER RISK			
		Route-Specific Risks			Calculated Risk	Route-Specific Risks			Calculated Risk
		Oral	Dermal	Inhalation		Oral	Dermal	Inhalation	
Inorganics		ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Arsenic	22	8.0E-07	2.1E-09	9.9E-14	8.0E-07	1.2E-01	3.1E-04	NA	0.12
				TOTAL ELCR	8E-07			TOTAL HI	0.1

ELCR Excess lifetime cancer risk.
EPCs Exposure point concentration in subsurface soil (Table 5-1) (mg/kg).
HI Hazard index.
HQ Hazard quotient.
mg/kg Milligrams per kilogram.
NA Not available.

TABLE 5-28
RISK CALCULATIONS FOR TEENAGE TRESPASSER EXPOSURE TO SLUDGE FOR SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs		CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
PAHs (µg/kg)			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Benzo(a)anthracene	4,500	*	3.7E-07	1.6E-07	2.8E-11	5.3E-07	1.2E-05	5.1E-06	NA	0.000017
Benzo(b)fluoranthene	5,700	*	4.7E-07	2.1E-07	6.7E-11	6.7E-07	1.5E-05	6.5E-06	NA	0.000021
Benzo(k)fluoranthene	270	*	2.2E-08	9.8E-09	6.7E-14	3.2E-08	7.0E-07	3.1E-07	NA	0.0000010
Benzo(a)pyrene	47,000	*	3.8E-06	1.7E-06	1.8E-10	5.5E-06	1.2E-04	5.3E-05	NA	0.00018
Chrysene	39	*	3.2E-09	1.4E-09	1.1E-13	4.6E-09	1.0E-07	4.4E-08	NA	########
Dibenzo(a,h)anthracene	3,200	*	2.6E-07	1.2E-07	6.1E-13	3.8E-07	8.3E-06	3.6E-06	NA	0.000012
Indeno(1,2,3-cd)pyrene	3,900	*	3.2E-07	1.4E-07	1.2E-15	4.6E-07	1.0E-05	4.4E-06	NA	0.000015
Inorganics (mg/kg)										
Arsenic	42	*	7.0E-07	9.4E-09	6.3E-14	7.1E-07	1.1E-02	1.4E-04	NA	0.011
Chromium	190	*	NAP	NAP	7.9E-13	7.9E-13	5.0E-03	3.1E-03	4.6E-09	0.0081
Mercury	9	*	NC	NC	NC	NC	NA	NA	7.0E-11	7.0E-11
Nickel	270	*	NC	NC	2.3E-14	2.3E-14	1.1E-03	7.1E-04	NA	0.0018
Selenium	150	*	NC	NC	NC	NC	2.3E-03	3.0E-05	NA	0.0024
					TOTAL ELCR	8E-06			TOTAL HI	0.02

*	EPC is equal to the maximum detected concentration.
ELCR	Excess lifetime cancer risk.
EPCs	Exposure point concentration in sludge waste (Table 5-2).
HI	Hazard index.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
NC	Not a suspected carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.

TABLE 5-29
RISK EQUATIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

ROUTE-SPECIFIC RISKS:

Oral:

$$\frac{ELCR_o}{\textit{or}\ HQ_o} = \frac{EPCgw \times IR \times EF \times EP}{BW \times (AP_C\ \textit{or}\ AP_{NC}) \times [(1/CSF_o)\ \textit{or}\ RfD_o]}$$

Dermal:

$$\frac{ELCR_d}{\textit{or}\ HQ_d} = \frac{EPCgw \times SSA \times PC \times (0.001\,L/cm^3) \times ET \times EF \times EP}{BW \times (AP_C\ \textit{or}\ AP_{NC}) \times [(1/CSF_a)\ \textit{or}\ RfD_a]}$$

Inhalation:

$$\frac{ELCR_i}{\textit{or}\ HQ_i} = \frac{EPCv \times IRC \times EF \times EP}{(AP_C\ \textit{or}\ AP_{NC}) \times [(0.001\,mg/\mu g)/UR_i\ \textit{or}\ RfC]}$$

where:

$$EPCv = \frac{EPCgw \times (10^3\ L/m^3)}{1/k_l + [RT/(k_g \times H)]} \times \frac{SA}{Hb \times Wb \times U}$$

CANCER RISK:

$$ELCR = ELCR_o + ELCR_d + ELCR_i$$

NON-CANCER RISK:

$$HI = HQ_o + HQ_d + HQ_i$$

where:

AP_C	Averaging period for cancer effects (days).
AP_{NC}	Averaging period for non-cancer effects (days).
BW	Body weight (kg).
CSF	Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg; inverse of mg/kg/day).
EF	Exposure frequency (days/year).
ELCR	Excess lifetime cancer risk (unitless).
ET	Exposure time (hours/day).
EP	Exposure period (years).
EPCgw	Exposure point concentration in groundwater (mg/L).
EPC_V	Exposure point concentration in the vapor phase (mg/m^3).
H	Henry's Law Constant (atm-m^3/mol).
Hb	Height of mixing zone (2 meters).
HI	Hazard index (unitless); sum of the HQs.
HQ	Hazard quotient (unitless).
IR	Incidental ingestion rate (L/day).
IR_A	Inhalation rate of air (m^3/day).
IRC	Inhalation rate correction factor, to correct for differences from the inhalation rate of 20 m^3/day assumed in the derivation of the inhalation toxicity values; calculated as IR_A/(20 m^3/day) (unitless).
k_g	Gas-phase mass transfer coefficient (m/sec) ~ (8.3 10^{-3} m/sec) $[(18\ g/mol)/MW]^{1/2}$.

TABLE 5-29
RISK EQUATIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

k_l	Liquid-phase mass transfer coefficient (m/sec) ~ (5.6 10^{-5} m/sec) [(44 g/mol)/MW]$^{1/2}$.
MW	Molecular weight (g/mol).
PC	Permeability constant (cm/hour).
RfC	Reference concentration for inhalation exposure (mg/m^3).
RfD	Reference dose for oral (RfD_o) or dermal (adjusted to an absorbed dose, RfD_a) exposure (mg/kg/day).
RT	Product of the universal gas constant (R = 8.206 10^{-5} atm-m^3/mol/K) and the relevant Kelvin temperature (T = 298 K); RT = 0.02445 atm-m^3/mol.
SA	Source area (1 m^2).
SSA	Exposed skin surface area (cm^2).
U	Mean wind speed (3.13 m/sec).
UR_i	Unit cancer risk for inhalation exposure (m^3/ g).
Wb	Width of mixing zone (1 meter).

<u>SAMPLE CALCULATION</u>: Benzene at SWMUs 38 & 39:

$$k_g = (8.3 \times 10^{-3} \text{ m/sec}) \times [(18 \text{ g/mol})/(78 \text{ g/mol})]^{1/2} = 4.0 \times 10^{-3} \text{ m/sec}$$

$$k_l = (5.6 \times 10^{-5} \text{ m/sec}) \times [(44 \text{ g/mol})/(78 \text{ g/mol})]^{1/2} = 4.2 \times 10^{-5} \text{ m/sec}$$

$$EPC_V = \frac{0.0054 \text{ mg/L} \times (10^3 \text{ L/m}^3)}{\left(\dfrac{1}{4.2 \times 10^{-5} \text{ m/sec}}\right) + \left(\dfrac{0.02445 \text{ atm}\cdot\text{m}^3/\text{mol}}{0.004 \text{ m/sec} \times 0.00548 \text{ atm}\cdot\text{m}^3/\text{mol}}\right)} \times \frac{1 \text{ m}^2}{2 \text{ m} \times 1 \text{ m} \times 3.13 \text{ m/sec}}$$

$$= 3.4 \times 10^{-5} \text{ mg/m}^3$$

<u>Cancer Risk</u>:

$$ELCR_o = \frac{0.0054 \text{ mg/L} \times 0.01 \text{ L/day} \times 90 \text{ days/yr} \times 1 \text{ yr}}{70 \text{ kg} \times 25{,}550 \text{ days} \times (1/0.055 \text{ kg}\cdot\text{day/mg})}$$

$$= 1.5 \times 10^{-10}$$

$$ELCR_d = \frac{0.0054 \text{ mg/L} \times 3{,}160 \text{ cm}^2 \times 0.021 \text{ cm/hr} \times 0.001 \text{ L/cm}^3 \times 1 \text{ hr/day} \times 90 \text{ days/yr} \times 1 \text{ yr}}{70 \text{ kg} \times 25{,}550 \text{ days} \times (1/0.055 \text{ kg}\cdot\text{day/mg})}$$

$$= 9.9 \times 10^{-10}$$

TABLE 5-29
RISK EQUATIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

$$ELCR_i = \frac{(3.4 \times 10^{-5}\ \text{mg/m}^3) \times 1 \times 90\ \text{days/yr} \times 1\ \text{yr}}{25{,}550\ \text{days} \times (0.001\ \text{mg/lg}) / (7.8 \times 10^{-6}\ \text{m}^3/\mu\text{g})}$$

$$= 9.4 \times 10^{-10}$$

$$ELCR = (1.5 \times 10^{-10}) + (9.9 \times 10^{-10}) + (9.4 \times 10^{-10}) = 2.1 \times 10^{-9}$$

Non-Cancer Risk:

$$HQ_o = \frac{0.0054\ \text{mg/L} \times 0.01\ \text{L/day} \times 90\ \text{days/yr} \times 1\ \text{yr}}{70\ \text{kg} \times 365\ \text{days} \times 0.003\ \text{mg/kg-day}}$$

$$= 0.000063$$

$$HQ_d = \frac{0.0054\ \text{mg/L} \times 3{,}160\ \text{cm}^2 \times 0.021\ \text{cm/hr} \times 0.001\ \text{L/cm}^3 \times 1\ \text{hr/day} \times 90\ \text{days/yr} \times 1\ \text{yr}}{70\ \text{kg} \times 365\ \text{days} \times 0.003\ \text{mg/kg-day}}$$

$$= 0.00042$$

$$HQ_i = \frac{(3.4 \times 10^{-5}\ \text{mg/m}^3) \times 1 \times 90\ \text{days/yr} \times 1\ \text{yr}}{365\ \text{days} \times (0.06\ \text{mg/m}^3)}$$

$$= 0.00014$$

$$HI = 0.0000063 + 0.00042 + 0.00014 = 0.00064$$

TABLE 5-30
RISK CALCULATIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER AT SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCgw	EPCv (mg/m^3)	Permeability Coefficient (cm/hr)	CANCER RISK Route-Specific Risks Oral			CANCER RISK Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral			NON-CANCER RISK Calculated Risk
				Oral	Dermal	Inhalation		Oral	Dermal	Inhalation	
				ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
VOC (µg/L)											
Acetone	84	8.8E-05	5.7E-04	NC	NC	NC	NC	3.0E-06	5.3E-07	NA	0.0000035
Inorganics (mg/L)											
Barium	0.28	NV	1.6E-04	NC	NC	NV	NC	1.4E-04	1.0E-04	NV	0.00024
Chromium	0.030	NV	1.6E-04	NAP	NAP	NV	NAP	5.3E-05	1.3E-04	NV	0.00019
						TOTAL ELCR	NC			TOTAL HI	0.0004

cm/hr	Centimeters per hour.
ELCR	Excess lifetime cancer risk.
EPCgw	Exposure point concentration in the groundwater (Table 5-3).
EPCv	Exposure point concentration in the vapor phase (mg/m^3).
HI	Hazard index (sum of HQs).
HQ	Hazard quotient.
mg/m^3	Milligrams per cubic meter.
µg/L	Micrograms per liter.
mg/L	Milligrams per liter.
NA	Not available.
NC	Not a suspected carcinogen.
NV	Not volatile.
VOC	Volatile organic compound.

TABLE 5-31
RISK EQUATIONS FOR POTABLE GROUNDWATER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

ROUTE-SPECIFIC RISKS:

Oral:

$$\begin{matrix} ELCR_o \\ \textit{or } HQ_o \end{matrix} = \frac{EPC_{GW} \times IR_W \times EF \times EP}{BW \times (AP_C \textit{ or } AP_{NC}) \times [(1/CSF_o) \textit{ or } RfD_o]}$$

Dermal: (only for residential exposure)

$$\begin{matrix} ELCR_d \\ \textit{or } HQ_d \end{matrix} = \frac{EPC_{GW} \times SSA \times PC \times ET_b \times EF \times EP}{BW \times (AP_C \textit{ or } AP_{NC}) \times (1{,}000 \text{ cm}^3 / \text{L}) \times [(1/CSF_a) \textit{ or } RfD_a]}$$

Inhalation: (only for residential exposure)

$$\begin{matrix} ELCR_i \\ \textit{or } HQ_i \end{matrix} = \frac{EPC_{GW} \times VF_W \times IRC \times EF \times EP}{(AP_C \textit{ or } AP_{NC}) \times [(0.001 \text{ mg/ìg/} / UR_i \textit{ or } RfC]}$$

CANCER RISK:

$$ELCR = ELCR_o + ELCR_d + ELCR_i$$

NON-CANCER RISK:

$$HI = HQ_o + HQ_d + HQ_i$$

where:

AP_C Averaging period for cancer effects (25,550 days).
AP_{NC} Averaging period for non-cancer effects (days); EP × 365 days/year.
BW Body weight (kg).
EPC_{GW} Constituent concentration in groundwater (mg/L).
CSF Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg; inverse of mg/kg/day).
EF Exposure frequency (days/year).
ELCR Excess lifetime cancer risk for oral ($ELCR_o$), dermal ($ELCR_d$), inhalation ($ELCR_i$) or total (ELCR) exposure (unitless).
EP Exposure period (years).
ET_b Exposure time while bathing or showering (hours/day).
HI Hazard index (unitless); sum of the HQs.
HQ Hazard quotient (unitless).
IR_A Inhalation rate of air (m^3/day).
IRC Inhalation rate correction factor, to correct for differences from the inhalation rate of 20 m^3/day
assumed in the derivation of the inhalation toxicity values; calculated as IR_A/(20 m^3/day) (unitless).
IR_W Ingestion rate of drinking water (L/day).
PC Permeability constant (cm/hour).
RfC Reference concentration for inhalation exposure (mg/m^3).
RfD Reference dose for oral (RfD_o) or dermal (adjusted to an absorbed dose, RfD_a) exposure (mg/kg/day).

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TABLE 5-31
RISK EQUATIONS FOR POTABLE GROUNDWATER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

SSA Exposed skin surface area (cm^2).
UR_i Unit cancer risk for inhalation exposure (m^3/ g).
VF_W Volatilization factor for volatile organic compounds (VOCs) from household tap water (0.5 L/m^3) (USEPA, 1991a).

SAMPLE CALCULATION: trichloroethene; residential exposure – SWMUs 38 and 39

Cancer Risk:

$$ELCR_o = \frac{(0.0014\ \text{mg/L}) \times (2\ \text{L/day}) \times (350\ \text{days/yr}) \times (30\ \text{yrs})}{(70\ \text{kg}) \times (25{,}550\ \text{days}) \times [1/(0.011\ \text{kg-day/mg})]}$$
$$= 1.8 \times 10^{-7}$$

$$ELCR_d = \frac{(0.0014\ \text{mg/L}) \times (18{,}000\ \text{cm}^2) \times (0.016\ \text{cm/hr}) \times (0.58\ \text{hr/day}) \times (350\ \text{day/yr}) \times (30\ \text{yrs})}{(70\ \text{kg}) \times (25{,}550\ \text{days}) \times (1{,}000\ \text{cm}^3/\text{L}) \times [1/(0.011\ \text{kg-day/mg})]}$$
$$= 1.5 \times 10^{-8}$$

$$ELCR_i = \frac{(0.0014\ \text{mg/L}) \times (0.5\ \text{L/m}^3) \times 0.75 \times (350\ \text{days/yr}) \times (30\ \text{yrs})}{(25{,}550\ \text{days}) \times [(0.001\ \text{mg/lg}\ )/(1.7 \times 10^{-6}\ \text{m}^3/\mu\text{g})]}$$
$$= 3.7 \times 10^{-7}$$

$$ELCR = (1.8 \times 10^{-7}) + (1.5 \times 10^{-8}) + (3.7 \times 10^{-7}) = 5.6 \times 10^{-7}$$

Non-Cancer Risk:

$$HQ_o = \frac{(0.0014\ \text{mg/L}) \times (2\ \text{L/day}) \times (350\ \text{days/yr}) \times (30\ \text{yrs})}{(70\ \text{kg}) \times (10{,}950\ \text{days}) \times (0.006\ \text{mg/kg/day})}$$
$$= 0.0064$$

$$HQ_d = \frac{(0.0014\ \text{mg/L}) \times (18{,}000\ \text{cm}^2) \times (0.016\ \text{cm/hr}) \times (0.58\ \text{hr/day}) \times (350\ \text{days/yr}) \times (30\ \text{yrs})}{(70\ \text{kg}) \times (10{,}950\ \text{days}) \times (1{,}000\ \text{cm}^3/\text{L}) \times (0.006\ \text{mg/kg/day})}$$
$$= 0.00053$$

$$HQ_i = \frac{(0.0014\ \text{mg/L}) \times (0.5\ \text{L/m}^3) \times 0.75 \times (350\ \text{days/yr}) \times (30\ \text{yrs})}{(10{,}950\ \text{days}) \times (NA\ \text{mg/m}^3)}$$
$$= NA \quad \text{(not available; insufficient toxicity data)}$$

$$HI = 0.0064 + 0.00053 + NA = 0.0069$$

TABLE 5-32
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO POTABLE GROUNDWATER AT SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCGW	CANCER RISK ELCR	NON-CANCER RISK HQ
VOCs (µg/L)			
Acetone	84	NC	0.00039
Inorganics (mg/L)			
Barium	0.28	NC	0.0019
Chromium	0.030	NAP	0.0047
	TOTAL	**NC**	TOTAL **0.007**

ELCR Excess lifetime cancer risk.
EPCGW Constituent concentration in groundwater.
HQ Hazard quotient.
µg/L Micrograms per liter.
mg/L Milligrams per liter.
NAP Not applicable; carcinogenic only by inhalation.
NC Not a suspected carcinogen.
VOCs Volatile organic compounds.

TABLE 5-33
RISK CALCULATIONS FOR RESIDENTIAL EXPOSURE TO GROUNDWATER AT SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPC_{GW}	CANCER RISK: Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK: Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
		ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
VOCs (µg/L)									
Acetone	84	NC	NC	NC	NC	2.3E-02	6.8E-05	NA	0.023
Inorganics (mg/L)									
Barium	0.28	NC	NC	--	NC	1.1E-01	1.3E-03	--	0.11
Chromium	0.030	NAP	NAP	--	NAP	2.7E-01	1.1E-02	--	0.29
				TOTAL ELCR	NC			TOTAL HI	0.4

--	Number is not appropriate or not applicable.
ELCR	Excess lifetime cancer risk.
EPC_{GW}	Constituent concentration in groundwater.
HI	Hazard index.
HQ	Hazard quotient.
µg/L	Micrograms per liter.
mg/L	Milligrams per liter.
NA	Not available; insufficient toxicity data.
NAP	Not applicable; carcinogenic only by inhalation.
NC	Not a suspected carcinogen.
VOCs	Volatile organic compounds.

TABLE 5-34
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO SURFICIAL SOIL FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs	CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk
PAHs (µg/kg)		ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Benzo(a)anthracene	1,600	2.0E-06	6.9E-08	5.4E-09	2.1E-06	2.6E-05	8.7E-07	NA	0.000027
Benzo(b)fluoranthene	720	9.2E-07	3.1E-08	4.7E-09	9.5E-07	1.2E-05	3.9E-07	NA	0.000012
Benzo(k)fluoranthene	31	4.0E-08	1.3E-09	4.2E-12	4.1E-08	5.1E-07	1.7E-08	NA	0.00000052
Benzo(a)pyrene	6,900	8.8E-06	3.0E-07	1.4E-08	9.1E-06	1.1E-04	3.7E-06	NA	0.00012
Chrysene	7.0	8.9E-09	3.0E-10	1.1E-11	9.2E-09	1.1E-07	3.8E-09	NA	0.00000012
Dibenzo(a,h)anthracene	310	4.0E-07	1.3E-08	3.2E-11	4.1E-07	5.1E-06	1.7E-07	NA	0.0000052
Indeno(1,2,3-cd)pyrene	570	7.3E-07	2.5E-08	3.6E-14	7.5E-07	9.3E-06	3.1E-07	NA	0.000010
Inorganics (mg/kg)									
Antimony	5.2	NC	NC	NC	NC	6.4E-03	6.1E-04	NA	0.0070
Cadmium	6.2	NAP	NAP	8.1E-13	8.1E-13	3.0E-03	2.6E-03	NA	0.0057
Chromium	59	NAP	NAP	5.1E-11	5.1E-11	9.6E-03	4.6E-04	1.2E-07	0.010
				TOTAL ELCR	1E-05			TOTAL HI	0.02

ELCR Excess lifetime cancer risk.
EPCs Exposure point concentration in surface soil (Table 5-4).
HI Hazard index.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NA Not available.
NAP Not applicable.
NC Not a suspected carcinogen.
PAHs Polycyclic aromatic hydrocarbons.

TABLE 5-35
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO SLUDGE FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs (mg/kg)		CANCER RISK				NON-CANCER RISK			
			Route-Specific Risks			Calculated Risk	Route-Specific Risks			Calculated Risk
			Oral	Dermal	Inhalation		Oral	Dermal	Inhalation	
Inorganics			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Antimony	18	*	NC	NC	NC	NC	2.2E-02	2.1E-03	NA	0.024
Cadmium	11	*	NAP	NAP	1.4E-12	1.4E-12	5.4E-03	4.7E-03	NA	0.010
Chromium	180	*	NAP	NAP	1.6E-10	1.6E-10	2.9E-02	1.4E-03	3.6E-07	0.031
Lead	1,700	*	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	4,500	*	NC	NC	NC	NC	7.3E-03	2.3E-05	NA	0.0074
					TOTAL ELCR	2E-10			TOTAL HI	0.07

*	EPC is equal to the maximum detected concentration.
ELCR	Excess lifetime cancer risk.
EPCs	Exposure point concentration in sludge waste (Table 5-5) (mg/kg).
HI	Hazard index.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
NC	Not a suspected carcinogen.

TABLE 5-36
RISK CALCULATIONS FOR TRESPASSER EXPOSURE TO SURFICIAL SOIL FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs	CANCER RISK				NON-CANCER RISK			
		Route-Specific Risks			Calculated Risk	Route-Specific Risks			Calculated Risk
		Oral	Dermal	Inhalation		Oral	Dermal	Inhalation	
PAHs (µg/kg)		ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Benzo(a)anthracene	1,600	1.3E-07	5.8E-08	9.9E-12	1.9E-07	4.2E-06	1.8E-06	NA	0.0000060
Benzo(b)fluoranthene	720	5.9E-08	2.6E-08	8.5E-12	8.5E-08	1.9E-06	8.2E-07	NA	0.0000027
Benzo(k)fluoranthene	31	2.5E-09	1.1E-09	7.7E-15	3.7E-09	8.1E-08	3.5E-08	NA	0.00000012
Benzo(a)pyrene	6,900	5.6E-07	2.5E-07	2.6E-11	8.1E-07	1.8E-05	7.8E-06	NA	0.000026
Chrysene	7.0	5.7E-10	2.5E-10	2.1E-14	8.3E-10	1.8E-08	7.9E-09	NA	0.000000026
Dibenzo(a,h)anthracene	310	2.5E-08	1.1E-08	5.9E-14	3.7E-08	8.1E-07	3.5E-07	NA	0.0000012
Indeno(1,2,3-cd)pyrene	570	4.7E-08	2.1E-08	1.7E-16	6.7E-08	1.5E-06	6.5E-07	NA	0.0000021
Inorganics (mg/kg)									
Antimony	5.2	NC	NC	NC	NC	1.0E-03	1.3E-03	NA	0.0023
Cadmium	6.2	NAP	NAP	3.9E-15	3.9E-15	4.9E-04	5.5E-03	NA	0.0060
Chromium	59	NAP	NAP	2.5E-13	2.5E-13	1.5E-03	9.7E-04	1.4E-09	0.0025
				TOTAL ELCR	1E-06			TOTAL HI	0.01

ELCR Excess lifetime cancer risk.
EPCs Exposure point concentration in surface soil (Table 5-4).
HI Hazard index.
µg/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
NA Not available.
NAP Not applicable.
PAHs Polycyclic aromatic hydrocarbons.

TABLE 5-37
RISK CALCULATIONS FOR TRESPASSER EXPOSURE TO SLUDGE FOR SWMU 24
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs (mg/kg)		CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
Inorganics			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Antimony	18	*	NC	NC	NC	NC	3.5E-03	4.4E-03	NA	0.0079
Cadmium	11	*	NAP	NAP	6.9E-15	6.9E-15	8.6E-04	9.7E-03	NA	0.011
Chromium	180	*	NAP	NAP	7.5E-13	7.5E-13	4.7E-03	2.9E-03	4.4E-09	0.0076
Lead	1,700	*	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	4,500	*	NC	NC	NC	NC	1.2E-03	4.9E-05	NA	0.0012
					TOTAL ELCR	8E-13			TOTAL HI	0.03

* EPC is equal to the maximum detected concentration.
ELCR Excess lifetime cancer risk.
EPCs Exposure point concentration in sludge waste (Table 5-5) (mg/kg).
HI Hazard index.
mg/kg Milligrams per kilogram.
NA Not available.
NAP Not applicable.
NC Not a suspected carcinogen.

TABLE 5-38
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO SLUDGE FOR SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs (mg/kg)		CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk
Inorganics			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Antimony	15	*	NC	NC	NC	NC	1.8E-02	1.8E-03	NA	0.020
Cadmium	12	*	NAP	NAP	1.6E-12	1.6E-12	5.9E-03	5.1E-03	NA	0.011
Zinc	3,100	*	NC	NC	NC	NC	5.1E-03	1.6E-05	NA	0.0051
					TOTAL ELCR	2E-12			TOTAL HI	0.04

*	EPC is equal to the maximum detected concentration.
ELCR	Excess lifetime cancer risk.
EPCs	Exposure point concentration in sludge waste (Table 5-7) (mg/kg).
HI	Hazard index.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
NC	Not a suspected carcinogen.

TABLE 5-39
RISK CALCULATIONS FOR TRESPASSER EXPOSURE TO SLUDGE FOR SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCs (mg/kg)		CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
Inorganics			ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
Antimony	15	*	NC	NC	NC	NC	2.9E-03	3.7E-03	NA	0.0066
Cadmium	12	*	NAP	NAP	7.5E-15	7.5E-15	9.4E-04	1.1E-02	NA	0.012
Zinc	3,100	*	NC	NC	NC	NC	8.1E-04	3.4E-05	NA	0.00084
					TOTAL ELCR	8E-15			TOTAL HI	0.02

* EPC is equal to the maximum detected concentration.
ELCR Excess lifetime cancer risk.
EPCs Exposure point concentration in sludge waste (Table 5-7) (mg/kg).
HI Hazard index.
mg/kg Milligrams per kilogram.
NA Not available.
NAP Not applicable.
NC Not a suspected carcinogen.

TABLE 5-40
RISK CALCULATIONS FOR CONSTRUCTION WORKER EXPOSURE TO GROUNDWATER AT SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCgw	EPCv (mg/m^3)	Permeability Coefficient (cm/hr)	CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK Route-Specific Risks Oral	Dermal	Inhalation	Calculated Risk
				ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
VOCs (µg/L)											
Acetone	160	1.7E-04	5.7E-04	NC	NC	NC	NC	5.6E-06	1.0E-06	NA	0.0000067
Benzene	5.4	3.4E-05	2.1E-02	1.5E-10	9.9E-10	9.4E-10	2.1E-09	6.3E-05	4.2E-04	1.4E-04	0.00063
Trichloroethene	1.4	7.0E-06	1.6E-02	7.7E-12	3.9E-11	4.2E-11	8.9E-11	8.2E-06	4.2E-05	NA	0.000050
Inorganics (mg/L)											
Barium	0.37	NV	1.6E-04	NC	NC	NV	NC	1.9E-04	1.3E-04	NV	0.00032
Chromium	0.0084	NV	1.6E-04	NAP	NAP	NV	NAP	1.5E-05	3.7E-05	NV	0.000052
Cyanide	0.38	NV	1.6E-04	NC	NC	NV	NC	6.7E-04	4.7E-05	NV	0.00072
Lead	0.017	NV	4.0E-06	NA	NA	NV	NA	NA	NA	NV	NA
Silver	0.026	NV	1.6E-04	NC	NC	NV	NC	1.8E-04	4.4E-05	NV	0.00023
						TOTAL ELCR	2E-09			TOTAL HI	0.002

cm/hr Centimeters per hour.
ELCR Excess lifetime cancer risk.
EPCgw Exposure point concentration in the groundwater (Table 5-8).
EPCv Exposure point concentration in the vapor phase (mg/m^3).
HI Hazard index (sum of HQs).
HQ Hazard quotient.
µg/L Micrograms per liter.
mg/L Milligrams per liter.
mg/m^3 Milligrams per cubic meter.
NA Not available.
NC Not a suspected carcinogen.
NV Not volatile.
VOCs Volatile organic compounds.

TABLE 5-41
RISK CALCULATIONS FOR SITE WORKER EXPOSURE TO POTABLE GROUNDWATER AT SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPCGW	CANCER RISK ELCR	NON-CANCER RISK HQ
VOCs (µg/L)			
Acetone	160	NC	0.016
Benzene	5.4	1.0E-06	0.018
Trichloroethene	1.4	5.4E-08	0.0023
Inorganics (mg/L)			
Barium	0.37	NC	0.05
Chromium	0.0084	NAP	0.027
Cyanide	0.38	NC	0.19
Lead	0.017	NA	NA
Silver	0.026	NC	0.05
		TOTAL **1E-06**	TOTAL **0.4**

ELCR	Excess lifetime cancer risk.
EPCGW	Constituent concentration in groundwater.
HQ	Hazard quotient.
µg/L	Micrograms per liter.
mg/L	Milligrams per liter.
NA	Not available; insufficient toxicity data.
NAP	Not applicable; carcinogenic only by inhalation.
NC	Not a suspected carcinogen.
VOCs	Volatile organic compounds.

TABLE 5-42
RISK CALCULATIONS FOR RESIDENTIAL EXPOSURE TO GROUNDWATER AT SWMUs 38 AND 39
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	EPC_{GW}	CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk	NON-CANCER RISK: Route-Specific Risks: Oral	Dermal	Inhalation	Calculated Risk
		ELCRo	ELCRd	ELCRi	ELCR	HQo	HQd	HQi	HI
VOCs (µg/L)									
Acetone	160	NC	NC	NC	NC	4.4E-02	1.3E-04	NA	0.044
Benzene	5.4	3.5E-06	3.8E-07	6.5E-06	1.0E-05	4.9E-02	5.4E-03	3.2E-01	0.38
Trichloroethene	1.4	1.8E-07	1.5E-08	3.7E-07	5.6E-07	6.4E-03	5.3E-04	NA	0.0069
Inorganics (mg/L)									
Barium	0.37	NC	NC	--	NC	1.4E-01	1.7E-03	--	0.15
Chromium	0.0084	NAP	NAP	--	NAP	7.7E-02	3.2E-03	--	0.080
Cyanide	0.38	NC	NC	--	NC	5.2E-01	6.0E-04	--	0.52
Lead	0.017	NA	NA	--	NA	NA	NA	--	NA
Silver	0.026	NC	NC	--	NC	1.4E-01	5.7E-04	--	0.14
				TOTAL ELCR	1E-05			TOTAL HI	1

--	Number is not appropriate or not applicable.	mg/L	Milligrams per liter.
ELCR	Excess lifetime cancer risk.	NA	Not available; insufficient toxicity data.
EPC_{GW}	Constituent concentration in groundwater.	NAP	Not applicable; carcinogenic only by inhalation.
HI	Hazard index.	NC	Not a suspected carcinogen.
HQ	Hazard quotient.	VOCs	Volatile organic compounds.
µg/L	Micrograms per liter.		

TABLE 5-43
REMEDIAL GOAL OPTION EQUATIONS FOR SOIL OR SLUDGE EXPOSURE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

ROUTE-SPECIFIC RGOs:

Oral:

$$(RGO_o)_C = \frac{TCR \times BW \times AP_C \times (10^6 \text{ mg/kg})}{IR_S \times EF \times EP \times CSF_o}$$

Dermal:

$$(RGO_d)_C = \frac{TCR \times BW \times AP_C \times (10^6 \text{ mg/kg})}{SSA \times SAR \times ABS_d \times EF \times EP \times CSF_a}$$

Inhalation:

$$(RGO_i)_C = \frac{TCR \times AP_C}{[(1/VF)+(1/PEF)] \times IRC \times EF \times EP \times \left(UR_i / 0.001 \frac{mg}{\mu g}\right)}$$

where:

$$VF = Q/C \times \frac{(3.1416 \times \alpha \times T)^{1/2}}{2 \times Dei \times Pa \times Kas} \times 10^{-4} m^2/cm^2$$

$$PEF = Q/C \times \frac{3{,}600 \text{ sec/hr}}{RPF \times (1-G) \times (Um/Ut)^3 \times Fx}$$

$$\alpha = \frac{Dei \times Pa}{Pa + [\rho s \times (1-Pa)/Kas]}$$

$$Dei = Di \times (Pa^{3.33}/Pt^2)$$

$$Kas = H/(RT \times Kd)$$

CANCER EFFECTS RGO:

$$RGO_C = \frac{1}{\frac{1}{(RGO_o)_C} + \frac{1}{(RGO_d)_C} + \frac{1}{(RGO_i)_C}}$$

TABLE 5-43
REMEDIAL GOAL OPTION EQUATIONS FOR SOIL OR SLUDGE EXPOSURE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

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where:

	Alpha; calculation intermediate (cm^2/sec).
ABS_d	Dermal absorption efficiency (unitless), constituent specific.
AP_C	Averaging period for cancer effects (years).
BW	Body weight (kg).
CSF	Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg; inverse of mg/kg/day).
Dei	Effective diffusivity (cm^2/sec).
Di	Diffusivity in air (cm^2/sec); constituent specific.
EP	Exposure period (years).
EF	Exposure frequency (days/year).
ET	Exposure time (hr/day).
Foc	Fraction organic carbon in soil (unitless) (0.02).
F_X	Function of Ut/Um (unitless) (0.000152); $F_X = 0.18 \times [\ 8x^3 + 12x\ ] \times \exp(-x^2)$, where $x = 0.886 \times (Ut/Um)$.
G	Fraction of vegetative cover (unitless); conservatively assumed as zero.
H	Henry's Law Constant (atm-m^3/mol); constituent specific.
IR_A	Inhalation rate of air (m^3/day).
IRC	Inhalation rate correction factor, to correct for differences from the inhalation rate of 20 m^3/day assumed in the derivation of the inhalation toxicity values; calculated as IR_A/(20 m^3/day) (unitless).
IR_S	Incidental soil ingestion rate (mg/day).
Kas	Soil-air partition coefficient (g soil/cm^3 air).
Kd	Soil-water partition coefficient (cm^3/g or mL/g); constituent specific. Kd is calculated as Foc × Koc.
Koc	Organic carbon partition coefficient (cm^3/g or mL/g); constituent specific.
Pa	Air-filled soil porosity (0.20, unitless).
PEF	Particulate emission factor (m^3/kg).
Pt	Total soil porosity (0.35, unitless).
Q/C	Emission flux per unit concentration (g/m^2/sec)/(kg/m^3).
s	True soil or particle density (2.65 g/cm^3).
RGO	Remedial goal options for soil (mg/kg); which are based on the route-specific RGOs (RGO_o for the oral route, RGO_d for the dermal route, and RGO_i for the inhalation route).
RPF	Respirable particle fraction (0.036 g/m^2/hr).
RT	Product of the ideal gas constant (8.206×10^{-5} atm-m^3/mol/K) and the Kelvin temperature (298 K at 25 °C) = 0.02445 atm-m^3/mol.
SAR	Skin adherence rate (mg/cm^2/day).
SSA	Exposed skin surface area (cm^2).
T	Exposure interval (7.9E+08 sec).
TCR	Target cancer risk (unitless).
Um	Wind speed, annual average (3.13 m/sec).
UR_i	Unit cancer risk for inhalation exposure (m^3/µg).
Ut	Equivalent threshold value of windspeed at 10 meters (12.8 m/sec).
VF	Volatilization factor (m^3/kg).

TABLE 5-43
REMEDIAL GOAL OPTION EQUATIONS FOR SOIL OR SLUDGE EXPOSURE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

SAMPLE CALCULATION: Benzo(a)pyrene site worker exposure, SWMUs 24, 38 & 39 based on TCR = 10^{-6}.

$$\text{Kas} = \frac{2.4\times10^{-6}\,\text{atm}\cdot\text{m}^3/\text{mol}}{0.02445\ \text{atm}\cdot\text{m}^3/\text{mol}\ \times 0.02 \times\ 1{,}149{,}000\ \text{cm}^3/\text{g}} = 4.27\times10^{-9}\,\text{g}/\text{cm}^3$$

$$\text{Dei} = 0.04653\ \text{cm}^2/\text{sec} \times (0.2^{3.33}/0.35^2) = 0.00179\ \text{cm}^2/\text{sec}$$

$$\alpha = \frac{0.00179\ \text{cm}^2/\text{sec}\ \times\ 0.2}{0.2\ +\ [2.65\,\text{g}/\text{cm}^3\ (1-0.2)/4.27\times10^{-9}\,\text{g}/\text{cm}^3]} = 7.2\times10^{-13}\text{cm}^2/\text{sec}$$

$$\text{PEF} = 75.0\,(\text{g}/\text{m}^2/\text{sec})/(\text{kg}/\text{m}^3)\times\frac{3{,}600\ \text{sec}/\text{hr}}{0.036\,\text{g}/\text{m}^2/\text{hr}\ \times\ (1-0)\ \times\ (3.13\ \text{m/sec}\ /\ 12.8\ \text{m/sec})^3\ \times\ 0.000152} = 3.38\times10^{12}\text{m}^3/\text{kg}$$

$$\text{VF} = 75.0\,(\text{g}/\text{m}^2/\text{sec})/(\text{kg}/\text{m}^3)\ \times\ \frac{[3.1416\ \times\ (7.2\times10^{-13}\text{cm}^2/\text{sec})\ \times\ (7.9\times10^8\ \text{sec})]^{1/2}}{2\ \times\ 0.00179\ \times\ 0.2\ \times\ (4.27\times10^{-9}\,\text{g}/\text{cm}^3)} = 1.03\times10^8\ \text{m}^3/\text{kg}$$

$$\text{RGO}_\text{O} = \frac{(1\ \times\ 10^{-6})\ \times\ 70\,\text{kg}\ \times\ 25{,}550\ \text{days}\ \times\ 10^6\,\text{mg}/\text{kg}}{50\ \text{mg}/\text{day}\ \times\ 250\ \text{days}/\text{yr}\ \times\ 25\ \text{yrs}\ \times\ 7.3\ \text{kg}\cdot\text{day}/\text{mg}} = 0.78\ \text{mg}/\text{kg}$$

$$\text{RGO}_\text{d} = \frac{(1\ \times\ 10^{-6})\ \times\ 70\,\text{kg}\ \times\ 25{,}550\ \text{days}\ \times\ 10^6\,\text{mg}/\text{kg}}{3{,}160\ \text{cm}^2\ \times\ 0.152\ \text{mg}/\text{cm}^2/\text{day}\ \times\ 0.03\ \times\ 250\ \text{days}/\text{yr}\ \times\ 25\ \text{yrs}\ \times\ 8.6\ \text{kg}\cdot\text{day}/\text{mg}} = 23\ \text{mg}/\text{kg}$$

$$\text{RGO}_\text{i} = \frac{(10^{-6})\times 25{,}550\ \text{days}}{\left[\left(1/1.03\times10^8\ \text{m}^3/\text{kg}\right)+\left(1/3.38\times10^{12}\ \text{m}^3/\text{kg}\right)\right]\times 1\times 250\ \text{days/yr}\times 25\ \text{yrs}\times\left(\frac{8.8\times10^{-4}\,\text{m}^3/\text{kg}}{0.001\ \text{mg}/\mu\text{g}}\right)}$$

$$= 480\ \text{mg/kg}$$

$$\text{RGO}_\text{C} = \frac{1}{\frac{1}{0.78\ \text{mg/kg}}+\frac{1}{23\ \text{mg/kg}}+\frac{1}{480\ \text{mg/kg}}} = 0.75\ \text{mg/kg}$$

TABLE 5-44
REMEDIAL GOAL OPTION EQUATIONS FOR POTABLE GROUNDWATER EXPOSURE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

ROUTE-SPECIFIC RGOs:

Oral:

$$(RGO_o)_C = \frac{TCR \times BW \times AP_C \times (1/CSF_o)}{IR_W \times EF \times EP}$$

Dermal:

$$(RGO_d)_C = \frac{TCR \times BW \times (1{,}000\ cm^3/L) \times AP_C \times (1/CSF_a)}{SSA \times PC \times ET_b \times EF \times EP}$$

Inhalation:

$$(RGO_i)_C = \frac{TCR \times AP_C \times [(0.001\ mg/\lg) / UR_i]}{VF_W \times IRC \times EF \times EP}$$

CANCER EFFECTS RGO:

$$RGO_C = \frac{1}{\frac{1}{(RGO_o)_C} + \frac{1}{(RGO_d)_C} + \frac{1}{(RGO_i)_C}}$$

where:

AP_C	Averaging period for cancer effects (25,550 days).
AP_{NC}	Averaging period for non-cancer effects (days); EP × 365 days/year.
BW	Body weight (kg).
CSF	Cancer slope factor for oral (CSF_o) or dermal (adjusted to an absorbed dose, CSF_a) exposure (kg-day/mg; inverse of mg/kg/day).
EF	Exposure frequency (days/year).
EP	Exposure period (years).
ET_b	Exposure time while bathing or showering (hours/day).
IR_A	Inhalation rate of air (m^3/day).
IRC	Inhalation rate correction factor, to correct for differences from the inhalation rate of 20 m^3/day assumed in the derivation of the inhalation toxicity values; calculated as IR_A/(20 m^3/day) (unitless).
IR_W	Ingestion rate of drinking water (L/day).
PC	Permeability constant (cm/hour).
RGO	Remedial goal option for groundwater; based on the route-specific RGOs for oral (RBG_o), dermal (RBG_d) and inhalation (RBG_i) exposure (milligrams per liter [mg/L]).
SSA	Exposed skin surface area (cm^2).
TCR	Target cancer risk (10^{-6}).
UC	Unit conversion (0.001 mg/ug).
UR_i	Unit cancer risk for inhalation exposure (m^3/ g).
VF_W	Volatilization factor for volatile organic compounds (VOCs) from household tap water (0.5 L/m^3) (USEPA, 1991a).

TABLE 5-44
REMEDIAL GOAL OPTION EQUATIONS FOR POTABLE GROUNDWATER EXPOSURE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

SAMPLE CALCULATION: Benzene, residential exposure

Cancer Effects:

$$(RBG_o)_C = \frac{(10^{-6}) \times (70 \text{ kg}) \times (25{,}550 \text{ days}) \times \left(\dfrac{1}{0.055 \text{ kg} \cdot \text{day/mg}}\right)}{(2 \text{ L/day}) \times (350 \text{ days/yr}) \times (30 \text{ yrs})}$$

$$= 0.0015 \text{ mg/L}$$

$$(RBG_d)_C = \frac{(10^{-6}) \times (70 \text{ kg}) \times (1{,}000 \text{ cm}^3\text{/L}) \times (25{,}550 \text{ days}) \times \left(\dfrac{1}{0.055 \text{ kg} \cdot \text{day/mg}}\right)}{(18{,}000 \text{ cm}^2) \times (0.021 \text{ cm/hr}) \times (0.58 \text{ hr/day}) \times (350 \text{ days/yr}) \times (30 \text{ yrs})}$$

$$= 0.014 \text{ mg/L}$$

$$(RGO_i)_C = \frac{(10^{-6}) \times (25{,}550 \text{ days}) \times \left(\dfrac{0.001 \text{ mg/}\mu\text{g}}{7.8 \times 10^{-6} \text{ m}^3\text{/}\mu\text{g}}\right)}{(0.5 \text{ L/m}^3) \times 0.75 \times (350 \text{ days/yr}) \times (30 \text{ yrs})}$$

$$= 0.00083 \text{ mg/L}$$

$$RBG_C = \frac{1}{\dfrac{1}{0.0015 \text{ mg/L}} + \dfrac{1}{0.014 \text{ mg/L}} + \dfrac{1}{0.00083 \text{ mg/L}}} = 0.00052 \text{ mg/L}$$

TABLE 5-45
REMEDIAL GOAL OPTION CONCENTRATIONS FOR SWMU 23 SLUDGE BASED ON SITE WORKER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RGO at Target Cancer Risk of: 10^{-4}	10^{-5}	10^{-6}	EPC
PAHs (µg/kg)				
Benzo(a)anthracene	16,000,000	1,600,000	160,000	4,500
Benzo(b)fluoranthene	16,000,000	1,600,000	160,000	5,700
Benzo(k)fluoranthene	160,000,000	16,000,000	1,600,000	270
Benzo(a)pyrene	1,600,000	160,000	16,000	47,000
Chrysene	1,600,000,000	160,000,000	16,000,000	39
Dibenzo(a,h)anthracene	1,600,000	160,000	16,000	3,200
Indeno(1,2,3-c,d)pyrene	16,000,000	1,600,000	160,000	3,900
Metals (mg/kg)				
Arsenic	7,900	790	79	42
Chromium*	NAP	NAP	NAP	190
Mercury	NC	NC	NC	8.6
Nickel	NAP	NAP	NAP	270
Selenium	NC	NC	NC	150

*	Values for chromium based on chromium VI.
(shaded)	EPC exceeds concentration at target risk level.
EPC	Exposure point concentration (Table 5-2).
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NAP	Not applicable; calculated RGO exceeds 1,000,000 mg/kg which is not possible.
NC	Not evaluated as a carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.
RGO	Remedial goal option.

TABLE 5-46
REMEDIAL GOAL OPTION CONCENTRATIONS FOR SWMU 23 SLUDGE BASED ON TRESPASSER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RGO at Target Cancer Risk of: 10^{-4}	10^{-5}	10^{-6}	EPC
PAHs (µg/kg)				
Benzo(a)anthracene	8,500,000	850,000	85,000	4,500
Benzo(b)fluoranthene	8,500,000	850,000	85,000	5,700
Benzo(k)fluoranthene	85,000,000	8,500,000	850,000	270
Benzo(a)pyrene	850,000	85,000	8,500	47,000
Chrysene	850,000,000	85,000,000	8,500,000	39
Dibenzo(a,h)anthracene	850,000	85,000	8,500	3,200
Indeno(1,2,3-c,d)pyrene	8,500,000	850,000	85,000	3,900
Metals (mg/kg)				
Arsenic	5,900	590	59	42
Chromium*	NAP	NAP	NAP	190
Mercury	NC	NC	NC	8.6
Nickel	NAP	NAP	NAP	270
Selenium	NC	NC	NC	150

*	Values for chromium based on chromium VI.
(shaded)	EPC exceeds concentration at target risk level.
EPC	Exposure point concentration (Table 5-2).
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NAP	Calculated RGO exceeds 1,000,000 mg/kg and this indicates that there is no risk from this pat
NC	Not evaluated as a carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.
RGO	Remedial goal option.

TABLE 5-47
REMEDIAL GOAL OPTION CONCENTRATIONS FOR SWMU 24, 38 AND 39 SURFICIAL SOIL AND SLUDGE BASED ON SITE WORKER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RGO at Target Cancer Risk of: 10^{-4}	10^{-5}	10^{-6}	EPC SWMU 24* Soil	EPC SWMU 24* Sludge Waste	EPC SWMU 38 & 39** Sludge Waste
PAHs (µg/kg)						
Benzo(a)anthracene	76,000	7,600	760	1,600	–	–
Benzo(b)fluoranthene	75,000	7,500	750	720	–	–
Benzo(k)fluoranthene	76,000	7,600	760	31	–	–
Benzo(a)pyrene	76,000	7,600	760	6,900	–	–
Chrysene	76,000	7,600	760	7.0	–	–
Dibenzo(a,h)anthracene	76,000	7,600	760	310	–	–
Indeno(1,2,3-c,d)pyrene	76,000	7,600	760	570	–	–
Metals (mg/kg)						
Antimony	NC	NC	NC	5.2	18	15
Cadmium	NAP	NAP	NAP	6.2	11	12
Chromium***	NAP	NAP	NAP	59	180	–
Lead	NA	NA	NA	–	1,700	–
Zinc	NC	NC	NC	–	4,500	3,100

*	EPC for surface soil (Table 5-3) and sludge waste (Table 5-4).
**	EPC for sludge waste only (Table 5-6).
***	Values for chromium based on chromium VI.
(shaded)	EPC exceeds concentration at target risk level.
–	Constituent was not a constituent of concern for the indicated data set.
EPC	Exposure point concentration (Tables 5-3, 5-4, and 5-6).
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available; insufficient toxicity data.
NAP	Not applicable; calculated concentration exceeds 1,000,000 mg/kg which is not possible.
NC	Not evaluated as a carcinogen.
PAHs	Polycyclic aromatic hydrocarbons.
RGO	Remedial goal option.
SWMU	Solid waste management unit.

TABLE 5-48
REMEDIAL GOAL OPTION CONCENTRATIONS FOR SWMUs 38 AND 39 GROUNDWATER BASED ON RESIDENTIAL EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Constituent	RGO at Target Cancer Risk of: 10^{-4}	10^{-5}	10^{-6}	SWMUs 38 & 39 Groundwater EPC
VOCs (µg/L)				
Acetone	NC	NC	NC	160
Benzene	52	5.2	0.52	5.4
Trichloroethene	250	25	2.5	1.4
Inorganics (mg/L)				
Barium	NC	NC	NC	0.37
Chromium	NAP	NAP	NAP	0.0084
Cyanide	NC	NC	NC	0.38
Lead	NA	NA	NA	0.017
Silver	NC	NC	NC	0.026

(shaded)	EPC exceeds concentration at the indicated target risk level.
EPC	Exposure point concentration (Table 5-8).
µg/L	Micrograms per liter.
mg/L	Milligrams per liter.
NA	Not available; insufficient toxicity data.
NAP	Not applicable; carcinogenic only by inhalation.
NC	Not evaluated as a carcinogen.
RGO	Remedial goal option.
SWMU	Solid waste management unit.
VOCs	Volatile organic compounds.

TABLE 5-49
REMEDIAL GOAL OPTION FOR SITE WORKER EXPOSURE TO LEAD IN SWMU 24 SLUDGE
Land Disposal RFI
Sloss Industries Corporation
Birmingham, Alabama

$$RGO_{lead} = \frac{\left(PbB_{adult,central,goal} - PbB_{adult,0}\right) \times AT}{BKSF \times IR_S \times AF_S \times EF_S}$$

where:

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95,goal}}{GSD_{i,adult}^{1.645} \times R_{fetal/maternal}}$$

where:

AF_s	Absolute gastrointestinal absorption fraction (0.12).
AT	Averaging time (365 days/year).
BKSF	Biokinetic slope factor (0.4 µg/dL per µg/day).
EF_s	Exposure frequency (250 days/year).
$GSD_{i,adult}$	Geometric standard deviation (1.8).
IR_s	Ingestion rate for soil (0.05 g/day).
$PbB_{adult,o}$	Typical blood lead concentration in adults in the absence of site exposures (2 µg/dL).
$PbB_{adult,central,goal}$	Goal for central blood lead concentrations that have site exposures (µg/dL).
$PbB_{fetal,0.95,goal}$	Goal for the 95th percentile blood lead concentrations among fetuses born to woman having exposures to site soils (10 µg/dL).
$R_{fetal/maternal}$	Constant of proportionality between fetal blood lead concentration at birth and maternal blood lead concentration (0.9).
RGO_{lead}	Risk-based remedial goal option for lead in soil (mg/kg).

Sample Calculation

$$PbB_{adult,central,goal} = \frac{10\ \mu g/dL}{1.8^{1.645} \times 0.9}$$
$$= 4.23\ \mu g/dL$$

$$RGO_{lead} = \frac{\left(4.23\ \mu g/dL - 2\ \mu g/dL\right) \times 365\ days/year}{0.4\ \frac{\mu g/dL}{\mu g/day} \times 0.05\ g/day \times 0.12 \times 250\ days/year} \times (1{,}000\ g/kg) \times (0.001\ mg/\mu g)$$

$$= 1{,}400\ mg/kg$$

TABLE 5-50
INPUT PROBABILITY DISTRIBUTION FUNCTIONS FOR MONTE CARLO SIMULATION RANDOM VARIABLES
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Random Variable	Input Probability Distribution Function	Reference
BW	CUSTOM (min-51; 5%-58.6; 10%-62.3; 15%-64.9; 25%-68.7; 50%-76.9; 75%-85.6; 85%-91.3; 90%-95.7;95%-102.7; max-107); correlated with SSA (0.6)	[a (min, max); b(percentiles)]
EF	SWMU 23: UNIFORM (min-2, max-12)	PJ
	Other SWMUs: TRIANGULAR (min-130, likeliest-240, max-255)	PJ, based on [c]
EP	CUSTOM (min-0; 25%-1; 50%-3.8; 75%-11; 90%-19; 95%-25; max-30)	[a]
EPC	CUSTOM (measured concentration data)	
	SWMU 24, Surface Soil:	[d]
	Benzo(a)anthracene: LOGNORMAL (mean-2.67, StdDev- 9.09)	
	Benzo(a)pyrene: LOGNORMAL (mean-1.658, StdDev- 4.082)	
	Dibenzo(a,h)anthracene: LOGNORMAL (mean-0.40, StdDev- 0.38)	
	Indeno(1,2,3-cd)pyrene: LOGNORMAL (mean-1.44, StdDev- 3.38)	
ET	SWMU 23: UNIFORM (min-0.5, max-2)	PJ
	Other SWMUs: TRIANGULAR (min-0, likeliest-8, max-9)	PJ
IR_S	CUSTOM (min-0, max-216; 67%-17; 83%-148) × 0.5 = CUSTOM (min-0, max-108; 67%-8.5; 83%-74)	[a]
SAR	NORMAL (mean-0.03, SD-0.003)	[b,e]
SSA	NORMAL (mean-2460, SD-240); correlated with BW (0.6)	[b]

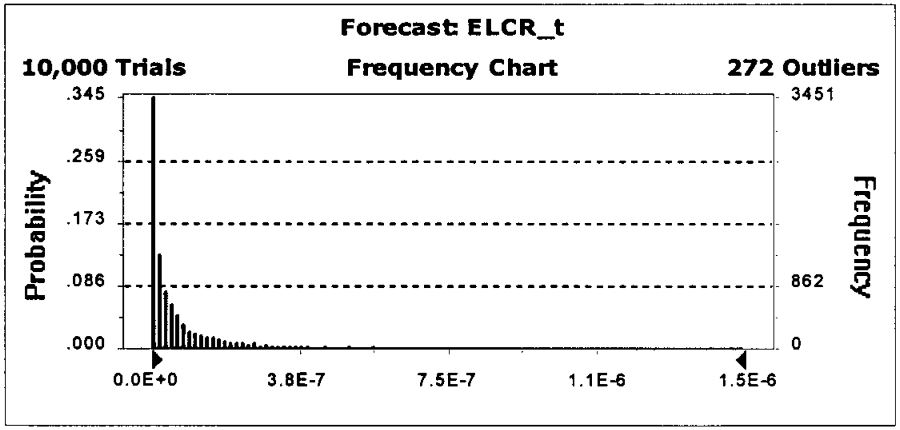
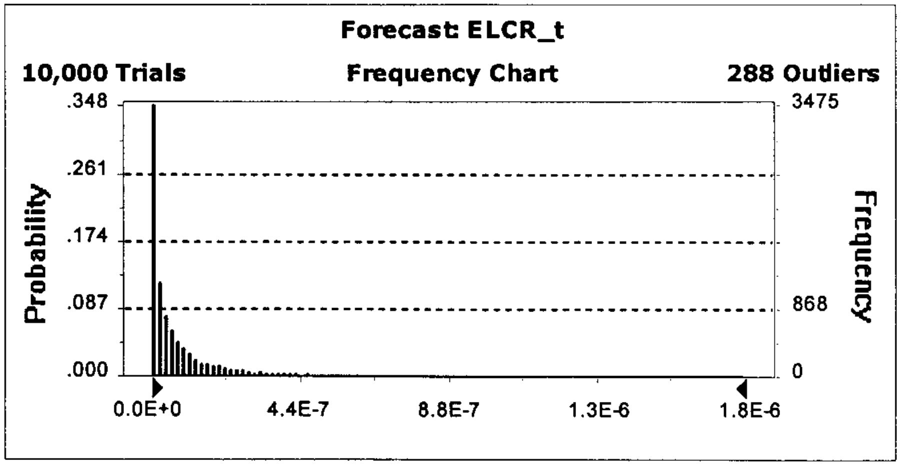
References

PJ	Professional judgment.
[a]	AIHC (1994).
[b]	USEPA (1995).
[c]	Residential distribution (Smith, 1994), modified to correspond to site worker exposure.
[d]	Lognormal distributions based on analytical data; derived using Crystal Ball 4.0® software.
[e]	Kissel, et al. (1996).

Definitions

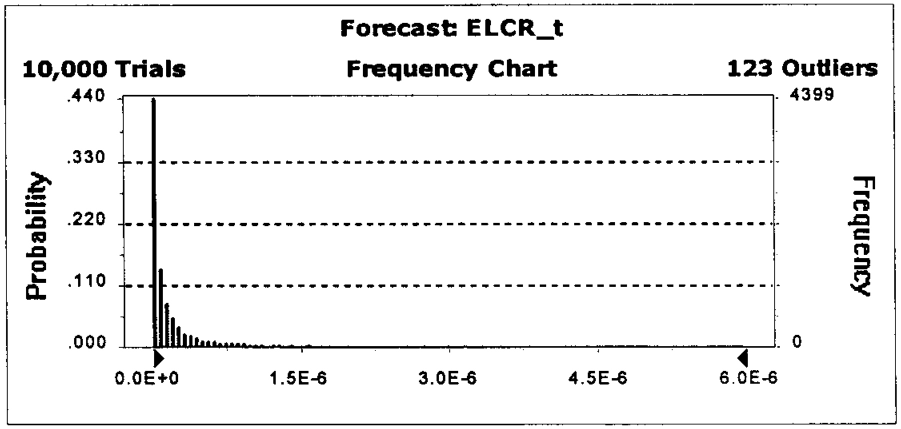
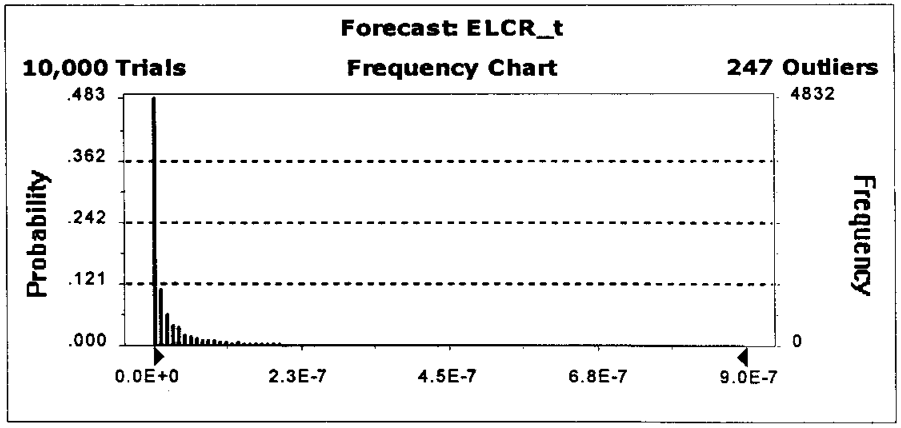
BW	Body weight (kilograms).
EF	Exposure frequency (days/year).
EPC	Exposure point concentration (mg/kg).
EP	Exposure period (years).
ET	Exposure time per day (hours/day).
IR_S	Ingestion rate of soil (mg/day).
SAR	Soil adherence rate (mg/cm^2/day).
SSA	Exposed skin surface area (cm^2).
StdDev	Standard deviation.

TABLE 5-51
RESULTS OF MONTE CARLO SIMULATION OF TOTAL CANCER RISK FOR SITE WORKER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Exposure Scenario	Cancer Risk (Total ELCR) Median	Mean	95% *	Output Probability Distribution for Total ELCR
SWMU 23 Sludge Waste	3E-08	2E-07	9E-07	
SWMU 24 Sludge Waste	4E-08	2E-07	1E-06	

Footnotes appear on page 2.

TABLE 5-51
RESULTS OF MONTE CARLO SIMULATION OF TOTAL CANCER RISK FOR SITE WORKER EXPOSURE
Land Disposal Areas RFI
Sloss Industries Corporation
Birmingham, Alabama

Exposure Scenario	Cancer Risk (Total ELCR) Median	Mean	95% *	Output Probability Distribution for Total ELCR
SWMU 24				
Surface Soil	8E-08	5E-07	2E-06	
SWMUs 38 & 39				
Sludge Waste	1E-08	9E-08	4E-07	

* 95th percentiles of the predicted risk probability distributions.

ELCR Excess lifetime cancer risk.

TABLE 5-52
Selection of Constituents of Ecological Concern in Subsurface Soil for SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

Constituents	Maximum Concentration	Background Concentration	ORNL Ecological Soil PRG	COEC Basis
VOCs (µg/kg)				
Acetone	110	NAP	NA	YES/A
Inorganics (mg/kg)				
Arsenic	30	11	2.66	YES/B,C
Barium	180	52	208	no/D
Beryllium	0.70	0.58	10	no/D,E
Cadmium	2.5	NAP	3	no/D
Chromium	19	30	0.4	no/E
Copper	22	8.3	50	no/D
Cyanide	0.43	NAP	NA	YES/A
Lead	19	12	50	no/D,E
Nickel	66	8.1	24	YES/B,C
Zinc	430	31	26	YES/B,C

A	No background or PRG value available for comparison; therefore retained as a COEC.
B	Greater than two times background value.
C	Greater than ORNL ecological soil PRG.
D	Less than ORNL ecological soil PRG.
E	Less than two times background value.
COEC	Constituent of ecological concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
ORNL	Oak Ridge National Laboratory.
PRG	Preliminary remediation goal.
VOCs	Volatile organic compounds.

TABLE 5-53
Selection of Constituents of Ecological Concern in Sludge for SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

Constituents	Maximum Concentration	Background Concentration	ORNL Ecological Soil PRG	COEC Basis
Carcinogenic PAHs (µg/kg)				
Benzo(a)anthracene	45,000	NAP	NA	YES/A
Benzo(b)fluoranthene	57,000	NAP	NA	YES/A
Benzo(k)fluoranthene	27,000	NAP	NA	YES/A
Benzo(a)pyrene	47,000	NAP	NA	YES/A
Chrysene	39,000	NAP	NA	YES/A
Dibenzo(a,h)anthracene	3,200	NAP	NA	YES/A
Indeno(1,2,3-cd)pyrene	39,000	NAP	NA	YES/A
Non-Carcinogenic PAHs (µg/kg)				
Acenaphthylene	11,000	NAP	NA	YES/A
Anthracene	3,800	NAP	NA	YES/A
Benzo(g,h,i)perylene	40,000	NAP	NA	YES/A
Fluoranthene	25,000	NAP	NA	YES/A
Fluorene	5,400	NAP	NA	YES/A
Naphthalene	4,100	NAP	NA	YES/A
Phenanthrene	14,000	NAP	NA	YES/A
Pyrene	31,000	NAP	NA	YES/A
VOCs (µg/kg)				
2-Butanone (MEK)	530	NAP	NA	YES/A
Acetone	1,200	NAP	NA	YES/A
Ethylbenzene	220	NAP	780,000,000	no/B
Toluene	5,100	NAP	200	no/B
Xylenes	900	NAP	NA	YES/A
Semi-VOCs (µg/kg)				
4-Methylphenol	10,000	NAP	NA	YES/A
Inorganics (mg/kg)				
Arsenic	42	11	2.66	YES/B,C
Barium	450	52	208	YES/B,C
Chromium	190	30	0.4	YES/B,C
Copper	240	8.3	50	YES/B,C
Cyanide	136	NAP	NA	YES/A
Lead	51	12	50	YES/B,C
Mercury	8.6	0.034	0.0185	YES/B,C
Nickel	270	8.1	24	YES/B,C
Selenium	150	NAP	0.79	YES/C
Silver	8.0	NAP	2	YES/C
Zinc	300	31	26	YES/B,C

Footnotes appear on page 2.

TABLE 5-53
Selection of Constituents of Ecological Concern in Sludge for SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

Concentrations are reported in milligrams per kilogram (mg/kg).

A	No background or PRG value available for comparison; therefore retained as a COEC.
B	Greater than two times background value.
C	Greater than ORNL ecological soil PRG.
D	Less than ORNL ecological soil PRG.
E	Less than two times background value.
COEC	Constituent of ecological concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
ORNL	Oak Ridge National Laboratory.
PAHs	Polycyclic aromatic hydrocarbons.
PRG	Preliminary remediation goal.
VOCs	Volatile organic compounds.

TABLE 5-54
Selection of Constituents of Ecological Concern in Subsurface Soil for SWMUs 38 and 39
Land Disposal Areas RFI
Sloss Industries Corporation

Constituents	Maximum Concentration	Background Concentration	ORNL Ecological Soil PRG	COC Basis
VOCs (µg/kg)				
Toluene	8.0	NAP	NA	YES/A
Inorganics (mg/kg)				
Antimony	9.6	NAP	5	YES/C
Arsenic	5.2	11	2.66	no/E
Barium	420	52	208	YES/B,C
Beryllium	2.8	0.58	10	no/D
Chromium	19	30	0.4	no/E
Copper	110	8.3	50	YES/B,C
Cyanide	1.3	NAP	NA	YES/A
Lead	36	12	50	no/D
Nickel	32	8.1	24	YES/B,C
Silver	7.6	NAP	2	YES/C
Zinc	190	31	26.3	YES/B,C

A	No background or PRG value available for comparison; therefore retained as a COEC.
B	Greater than two times background value.
C	Greater than ORNL ecological soil PRG.
D	Less than ORNL ecological soil PRG.
E	Less than two times background value.
COEC	Constituent of ecological concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
ORNL	Oak Ridge National Laboratory.
PRG	Preliminary remediation goal.
VOCs	Volatile organic compounds.

TABLE 5-55
Selection of Constituents of Ecological Concern in Sludge for SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation

Constituents	Maximum Concentration	Background Concentration	ORNL Ecological Soil PRG	COC Basis
Carcinogenic PAHs (µg/kg)				
Benzo(k)fluoranthene	630	NAP	NA	YES/A
Inorganics (mg/kg)				
Antimony	15	NAP	5	YES/C
Arsenic	8.8	11	2.66	no/E
Barium	260	52	208	YES/B,C
Beryllium	2.3	0.58	10	no/D
Cadmium	12	NAP	3	YES/C
Copper	160	8.3	50	YES/B,C
Cyanide	8.3	NAP	NA	YES/A
Lead	320	12	50	YES/B,C
Nickel	25	8.1	24	YES/B,C
Silver	4.6	NAP	2	YES/C
Zinc	3,100	31	26.3	YES/B,C

A	No background or PRG value available for comparison; therefore retained as a COEC.
B	Greater than two times background value.
C	Greater than ORNL ecological soil PRG.
D	Less than ORNL ecological soil PRG.
E	Less than two times background value.
COEC	Constituent of ecological concern.
µg/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
NA	Not available.
NAP	Not applicable.
ORNL	Oak Ridge National Laboratory.
PRG	Preliminary remediation goal.
VOCs	Volatile organic compounds.

TABLE 5-56
Toxicological Benchmark Values for Eastern Cottontail Rabbit
Land Disposal Areas RFI
Sloss Industriesl Corporation

Constituent	Test Species [a]	Experimental Value [b] (mg/kg/day)		NOAEL (mg/kg/day)	Measurement Endpoint	Reference [c]	Scaling Factor	Rabbit Toxicological Benchmark [d] (mg/kg/day)
VOCs								
2-Butanone	NA	NA		NA	NA	NA	NA	NA
Acetone	Rat	100	e	10	Reproduction	Sample et al., 1996	0.73	7.35
Toluene	Mouse	259.8	f	25.98	Reproduction	Sample et al., 1996	0.40	10.33
Xylene (mixed isomers)	Mouse	2.06	g	2.06	Reproduction	Sample et al., 1996	0.40	0.82
Semi-VOCs								
4-Methylphenol	NA	NA		NA	NA	NA	NA	NA
Acenaphthylene	NA	NA		NA	NA	NA	NA	NA
Anthracene	Mouse	1,000	e	100	No observed effects	IRIS, 1997	0.40	39.76
Benzo(a)anthracene	NA	NA		NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA		NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA		NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA		NA	NA	NA	NA	NA
Benzo(a)pyrene	Mouse	10	f	1	Reproduction	Sample et al., 1996	0.40	0.40
Chrysene	NA	NA		NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA		NA	NA	NA	0.40	NA
Fluoranthene	Mouse	125	e	12.5	Nephropathy	IRIS, 1997	0.40	4.97
Fluorene	Mouse	125	e	12.5	Decreased RBC	IRIS, 1997	0.40	4.97
Indeno(1,2,3-cd)pyrene	NA	NA		NA	NA	NA	NA	NA
Naphthalene	NA	NA		NA	NA	NA	NA	NA
Phenanthrene	NA	NA		NA	NA	NA	NA	NA
Pyrene	Mouse	75	e	7.5	Kidney Effects	IRIS, 1997	0.40	2.98
Inorganics								
Arsenic	Mouse	1.26	f	0.126	Reproduction	Sample et al., 1996	0.40	0.05
Barium (chloride)	Rat	5.1	g	5.1	Growth	Sample et al., 1996	0.73	3.75
Cadmium (soluble salt)	Rat	1	g	1	Reproduction	Sample et al., 1996	0.63	0.63
Chromium III	Rat	2,737	g	2,737	Reproduction	Sample et al., 1996	0.73	2,011.39
Chromium VI	Rat	13.14	f	1.3	Growth, food consmp	Sample et al., 1996	0.73	0.96

Footnotes on page 2.

TABLE 5-56
Toxicological Benchmark Values for Eastern Cottontail Rabbit
Land Disposal Areas RFI
Sloss Industriesl Corporation

Constituent	Test Species [a]	Experimental Value [b] (mg/kg/day)		NOAEL (mg/kg/day)	Measurement Endpoint	Reference [c]	Scaling Factor	Rabbit Toxicological Benchmark [d] (mg/kg/day)
Inorganics (cont.)								
Copper (sulfate)	Mink	11.71	g	11.71	Reproduction	Sample et al., 1996	0.96	11.19
Cyanide (K cyanide)	Rat	68.7	g	68.7	Reproduction	Sample et al., 1996	0.61	41.94
Lead (acetate)	Rat	8	g	8	Reproduction	Sample et al., 1996	0.73	5.88
Mercury (sulfide)	Mouse	13.3	g	13.3	Reproduction	Sample et al., 1996	0.40	5.29
Mercury (methyl mercury)	Rat	0.032	g	0.032	Reproduction	Sample et al., 1996	0.73	0.02
Nickel (sulfate)	Rat	40	g	40	Reproduction	Sample et al., 1996	0.73	29.40
Selenium	Rat	0.2	g	0.2	Reproduction	Sample et al., 1996	0.73	0.15
Silver	Mouse	18.1	f	1.8	Systemic	Rungby & Danscher,1984	0.35	0.63
Zinc (oxide)	Rat	160	g	160	Reproduction	Sample et al., 1996	0.73	117.58

[a]	Species in which the experimental (literature derived) value was reported.
[b]	Daily dose reported in the literature to cause toxicity endpoint.
[c]	Reference where experimental value was found.
[d]	Toxicological benchmark value = Benchmark value x scaling factor. Scaling factor is discussed in text.
[e]	Subchronic NOAEL
[f]	Chronic LOAEL
[g]	Chronic NOAEL
[h]	Subchronic LOAEL
mg/kg/day	Milligrams per kilogram per day.
LOAEL	Lowest observed adverse effect level.
NA	Not available.
NOAEL	No observed adverse effect level.

TABLE 5-57
Soil-To-Plant Uptake Factors
Land Disposal Areas RFI
Sloss Industries Corporation

Constituent	Log Kow [a]	Soil-to-Plant Uptake Factor [b]
VOCs		
Acetone	-0.24	0
2-Butanone	0.29	1.86
Ethylbenzene	3.15	0.56
Toluene	2.8	0.60
Xylene	3.2	0.56
Semi-VOCs		
4-Methylphenol	3.01	0.58
Acenaphthene	4.33	0.48
Acenapthylene	4.1	0.49
Anthracene	4.54	0.47
Benzo(a)anthracene	5.91	0.41
Benzo(a)pyrene [c]	6.5	0.39
Benzo(b)fluoranthene	6.57	0.39
Benzo(g,h,i)perylene	7.1	0.38
Benzo(k)fluoranthene	6.85	0.38
Chrysene	5.91	0.41
Dibenzo(a,h)anthracene	6.5	0.39
Fluoranthene	5.22	0.44
Fluorene	4.38	0.48
Indeno(1,2,3-cd)pyrene	7.7	0.36
Naphthalene	4.7	0.46
Phenanthrene	4.6	0.47
Pyrene	5.3	0.43
Metals		
Antimony	NA	0.20 [d]
Arsenic	NA	0.04 [d]
Barium	NA	0.15 [d]
Beryllium	NA	0.01 [d]
Cadmium	NA	0.55 [d]
Chromium III	NA	0.008 [d]
Chromium VI	NA	0.008 [d]
Copper	NA	0.40 [d]
Lead	NA	0.45 [d]
Mercury	NA	0.90 [d]
Nickel	NA	0.06 [d]
Selenium	NA	0.025 [d]
Silver	NA	0.40 [d]
Zinc	NA	1.5 [d]

[a] Montgomery and Welkom, 1990.
[b] Calculated according to Travis and Arms, 1988, unless otherwise noted.
[c] Yadiv et al., 1981.
[d] Baes et al., 1984
Kow Octanol/water partition coefficient.

TABLE 5-58
Exposure of Cottontail Rabbit to Soil and Associated Hazard Quotients, SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

Constituent	Cs [a] (mg/kg)	PU [b] (unitless)	Cveg (mg/kg)	Iv (kg/day)	Is (kg/day)	H (unitless)	BW (kg)	Exposure (mg/kg/day)	Benchmark [c] (mg/kg/day)	Hazard Quotient (unitless)
VOCs										
Acetone	0.061	0	0	0.237	0.015	1.0	1.2	0.0008	7.35	1.0E-04
Inorganics										
Arsenic	22	0.04	0.132	0.237	0.015	1.0	1.2	0.3011	0.05	6.0E+00
Cyanide	0.36	1	0.054	0.237	0.015	1.0	1.2	0.0152	41.94	3.6E-04
Nickel	66	0.06	0.594	0.237	0.015	1.0	1.2	0.9423	29.4	3.2E-02
Zinc	230	1.5	51.75	0.237	0.015	1.0	1.2	13.0956	117.58	1.1E-01
									HI	6

[a] Constituent concentration in SWMU 23 subsurface soil from Table 5-1.
[b] Plant uptake factor discussed in text.
[c] Toxicological benchmark from Table 5-39.

BW Body weight.
Cs Constituent concentration in subsurface soil.
Cveg Constituent concentration in vegetation (Cs x PU).
H Home range/area of concern. Assumed to be 1.
HI Hazard index (sum of the hazard quotients).
Is Ingestion rate of soil.
Iv Ingestion rate of vegetation.
mg/kg/day Milligrams per kilograms per day.
NA Not available.
PU Plant uptake factor.

TABLE 5-59
Exposure of Cottontail Rabbit to Sludge and Associated Hazard Quotients, SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

Constituent	Cs [a] (mg/kg)	PU [b] (unitless)	Cveg (mg/kg)	Iv (kg/day)	Is (kg/day)	H (unitless)	BW (kg)	Exposure (mg/kg/day)	Benchmark [c] (mg/kg/day)	Hazard Quotient (unitless)
VOCs										
2-Butanone (MEK)	0.53	1.86	0.15	0.237	0.015	1.0	1.2	0.0358	NA	NA
Acetone	1.2	0	0	0.237	0.015	1.0	1.2	0.0150	7.35	2.0E-03
Xylenes	0.90	0.56	0.0756	0.237	0.015	1.0	1.2	0.0262	0.82	3.2E-02
SVOCs										
4-Methylphenol	10	0.58	0.87	0.237	0.015	1.0	1.2	0.2968	NA	NA
Acenaphthylene	11	0.04	0.066	0.237	0.015	1.0	1.2	0.1505	NA	NA
Anthracene	3.8	0.47	0.2679	0.237	0.015	1.0	1.2	0.1004	39.76	2.5E-03
Benzo(a)anthracene	45	0.41	2.7675	0.237	0.015	1.0	1.2	1.1091	NA	NA
Benzo(b)fluoranthene	57	0.39	3.3345	0.237	0.015	1.0	1.2	1.3711	NA	NA
Benzo(g,h,i)perylene	40	0.38	2.28	0.237	0.015	1.0	1.2	0.9503	NA	NA
Benzo(k)fluoranthene	27	0.38	1.539	0.237	0.015	1.0	1.2	0.6415	NA	NA
Benzo(a)pyrene	47	0.39	2.7495	0.237	0.015	1.0	1.2	1.1305	0.4	2.8E+00
Chrysene	39	0.41	2.3985	0.237	0.015	1.0	1.2	0.9612	NA	NA
Dibenzo(a,h)anthracene	3.2	0.39	0.1872	0.237	0.015	1.0	1.2	0.0770	NA	NA
Fluoranthene	25	0.44	1.65	0.237	0.015	1.0	1.2	0.6384	4.97	1.3E-01
Fluorene	5.4	0.48	0.3888	0.237	0.015	1.0	1.2	0.1443	4.97	2.9E-02
Indeno(1,2,3-cd)pyrene	39	0.36	2.106	0.237	0.015	1.0	1.2	0.9034	NA	NA
Naphthalene	4.1	0.46	0.2829	0.237	0.015	1.0	1.2	0.1071	NA	NA
Phenanthrene	14	0.47	0.987	0.237	0.015	1.0	1.2	0.3699	NA	NA
Pyrene	31	0.43	1.9995	0.237	0.015	1.0	1.2	0.7824	2.98	2.6E-01
Inorganics										
Arsenic	42	0.04	0.252	0.237	0.015	1.0	1.2	0.5748	0.05	1.1E+01
Barium	450	0.15	10.125	0.237	0.015	1.0	1.2	7.6247	3.75	2.0E+00
Chromium	190	0.008	0.228	0.237	0.015	1.0	1.2	2.4200	2011.39	1.2E-03
Copper	240	0.4	14.4	0.237	0.015	1.0	1.2	5.8440	11.19	5.2E-01
Cyanide	140	1	21	0.237	0.015	1.0	1.2	5.8975	41.94	1.4E-01
Lead	51	0.45	3.4425	0.237	0.015	1.0	1.2	1.3174	5.88	2.2E-01
Mercury	8.6	0.90	1.161	0.237	0.015	1.0	1.2	0.3368	0.02	1.7E+01
Nickel	270	0.06	2.430	0.237	0.015	1.0	1.2	3.8549	29.4	1.3E-01
Selenium	150	0.0	0.5625	0.237	0.015	1.0	1.2	1.9861	0.15	1.3E+01
Silver	8.0	0.4	0.48	0.237	0.015	1.0	1.2	0.1948	0.63	3.1E-01
Zinc	300	1.5	67.5	0.237	0.015	1.0	1.2	17.0813	117.58	1.5E-01
									HI	950

Footnotes on page 2.

TABLE 5-59
Exposure of Cottontail Rabbit to Sludge and Associated Hazard Quotients, SWMU 23
Land Disposal Areas RFI
Sloss Industries Corporation

[a]	Constituent concentration in SWMU 23 sludge waste samples from Table 5-2.
[b]	Plant uptake factor discussed in text.
[c]	Toxicological benchmark from Table 5-39.
BW	Body weight.
Cs	Constituent concentration in waste sludge.
Cveg	Constituent concentration in vegetation (Cs x PU).
H	Home range/area of concern. Assumed to be 1.
HI	Hazard index (sum of the hazard quotients).
Is	Ingestion rate of soil.
Iv	Ingestion rate of vegetation.
mg/kg/day	Milligrams per kilograms per day.
NA	Not available.
PU	Plant uptake factor.

TABLE 5-60
Exposure of Cottontail Rabbit to Soil and Associated Hazard Quotients, SWMU 38 and 39
Land Disposal Areas RFI
Sloss Industries Corporation

Constituent	Cs [a] (mg/kg)	PU [b] (unitless)	Cveg (mg/kg)	Iv (kg/day)	Is (kg/day)	H (unitless)	BW (kg)	Exposure (mg/kg/day)	Benchmark [c] (mg/kg/day)	Hazard Quotient (unitless)
VOCs										
Toluene	0.0040	0.6	0.0004	0.237	0.015	1.0	1.2	0.0001	10.33	1.2E-05
Inorganics										
Antimony	4.1	0.2	0.123	0.237	0.015	1.0	1.2	0.0755	0.05	1.5E+00
Barium	400	0.15	9	0.237	0.015	1.0	1.2	6.7775	3.75	1.8E+00
Copper	25	0.4	1.5	0.237	0.015	1.0	1.2	0.6088	11.19	5.4E-02
Cyanide	0.28	1	0.042	0.237	0.015	1.0	1.2	0.0118	41.94	2.8E-04
Nickel	29	0.06	0.261	0.237	0.015	1.0	1.2	0.4140	29.4	1.4E-02
Silver	1.2	0.4	0.072	0.237	0.015	1.0	1.2	0.0292	0.63	4.6E-02
Zinc	91	1.5	20.475	0.237	0.015	1.0	1.2	5.1813	117.58	4.4E-02
									HI	3

[a] Constituent concentration in SWMU 38 and 39 subsurface soil from Table 5-5.
[b] Plant uptake factor discussed in text.
[c] Toxicological benchmark from Table 5-39.

BW Body weight.
Cs Constituent concentration in subsurface soil.
Cveg Constituent concentration in vegetation (Cs x PU).
H Home range/area of concern. Assumed to be 1.
HI Hazard index (sum of the hazard quotients).
Is Ingestion rate of soil.
Iv Ingestion rate of vegetation.
mg/kg/day Milligrams per kilograms per day.
NA Not available.
PU Plant uptake factor.

TABLE 5-61
Exposure of Cottontail Rabbit to Sludge and Associated Hazard Quotients, SWMU 39
Land Disposal Areas RFI
Sloss Industries Corporation

Constituent	Cs [a] (mg/kg)	PU [b] (unitless)	Cveg (mg/kg)	Iv (kg/day)	Is (kg/day)	H (unitless)	BW (kg)	Exposure (mg/kg/day)	Benchmark [c] (mg/kg/day)	Hazard Quotient (unitless)
SVOCs										
Benzo(k)fluoranthene	0.63	0.38	0.03591	0.237	0.015	1.0	1.2	0.0150	NA	NA
Inorganics										
Antimony	15	0.2	0.45	0.237	0.015	1.0	1.2	0.2764	0.05	5.5E+00
Barium	260	0.15	5.85	0.237	0.015	1.0	1.2	4.4054	3.75	1.2E+00
Cadmium	12	0.04	0.072	0.237	0.015	1.0	1.2	0.1642	0.01	1.6E+01
Copper	160	0.4	9.6	0.237	0.015	1.0	1.2	3.8960	11.19	3.5E-01
Cyanide	8.3	1	1.245	0.237	0.015	1.0	1.2	0.3496	41.94	8.3E-03
Lead	320	0.45	21.6	0.237	0.015	1.0	1.2	8.2660	5.88	1.4E+00
Nickel	25	0.06	0.225	0.237	0.015	1.0	1.2	0.3569	29.4	1.2E-02
Silver	4.6	0.4	0.276	0.237	0.015	1.0	1.2	0.1120	0.63	1.8E-01
Zinc	3,100	1.5	697.5	0.237	0.015	1.0	1.2	176.5063	117.58	1.5E+00
									HI	27

[a] Constituent concentration in SWMU 38 and 39 sludge waste samples from Table 5-6.
[b] Plant uptake factor discussed in text.
[c] Toxicological benchmark from Table 5-39.

BW Body weight.
Cs Constituent concentration in subsurface soil.
Cveg Constituent concentration in vegetation (Cs x PU).
H Home range/area of concern. Assumed to be 1.
HI Hazard index (sum of the hazard quotients).
Is Ingestion rate of soil.
Iv Ingestion rate of vegetation.
mg/kg/day Milligrams per kilograms per day.
NA Not available.
PU Plant uptake factor.

VOLUME I

APPENDIX A

FIELD LOGS

VOLUME I

APPENDIX A.1

SURFICIAL SOIL SAMPLING

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-02~~ 24-SL0002 KT 1/6/98

Sample I.D. No. 970618-LD-24-SL0002 ~~(0-1')~~ KT Coded/Replicate No.

Date 6/18/97 Time of Sampling: Begin 1600 End

Weather Sunny 80's

Site Description Down bank from lime pile just east of drainage ditch

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content Moist

Color Mod brown (5YR 4/4) & light brown (5YR 5/6) mottled Odor —

Description Clay, stiff (CL)

Analyses Required / Container Description

From Lab X or G&M

Analyses Required	Container Description
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x 8 oz 3x4

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ Mixed in stainless steel bowl with stainless steel spoon
Soil at surface

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015

Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-02~~ 24-SL0003 KT 1/6/98

Sample I.D. No. 970617 -LD-24 -SL 0003 ~~(0-1)~~ KT

Coded/Replicate No. 970617-LD-24-FB0001 / 970617-LD-24-EB00 / 970617-LD-24-FB0002 / 970617-LD-24-EB00

Date 6/17/97 Time of Sampling: Begin 1210 End

Weather OVERCAST 80's

Site Description ± 10' EAST OF GATE AS INDICATED ON PROPOSED LOCATION MAP

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color MOD BROWN (5YR 3/4) w/ SOME VERY DARK RED (5R 2/6) Odor NONE

Description CLAY w/ SOME ROCK (RED MTN S/S + SOME POSSIBLE L.S.)
CLAY WAS VERY BRITTLE w/ SOME ROOTS (CL)

Analyses Required	Container Description (From Lab X or G&M)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~ CH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's MIXED ~~Composited~~ in stainless steel bowl with stainless steel spoon SOIL AT 8" UNDER MINOR FLO DUST
EB + FB COLLECTED, FB + EB SPLIT w/ GUARDIAN ALSO CRYSTAL SPRINGS DISTILLED H_2O
(BTLO 5/19/97 AP 14:43 EXP 5/19/99) FB
" " AP 18:14 " " EB

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-04~~ 24-SL0004 KP 1/6/98

Sample I.D. No. 970617 -LD- 24 -SL0004 ~~(0-1')~~ KP Coded/Replicate No. —

Date 6/17/97 Time of Sampling: Begin 1530 End

Weather LIGHT RAIN, 70's, CLOUDY

Site Description PARTWAY BETWEEN FLUDUST PILE ACCESS GATE & BTF GATE AS PER SAMPLING PLAN. ADJACENT TO TWO TELEPHONE POLES & PROPERTY LINE FENCE

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color MOD BROWN (5YR 4/4) & GRAYISH ORANGE (10YR 7/4) MOTTLED Odor —

Description CLAY, PLASTIC, COHESIVE. (CH)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
CLAY AT SURFACE

Sampler(s) J. Hughes/David Page

Southpoint 89 1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-05~~ 24-SL0005 (EH 1/6/98)

Sample I.D. No. 970617 -LD-24 -SL0005 ~~(0-1')~~ Coded/Replicate No. SPLIT W/ GUARDIAN

Date 6/17/97 Time of Sampling: Begin 1615 End

Weather CLOUDY, 70's, VERY LIGHT RAIN

Site Description SE CORNER OF SWMU 24 AS NOT PROPOSED IN WORKPLAN

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST → SATURATED

Color DUSKY BROWN (5YR 2/2) Odor —

Description CLAY, VERY LOOSE, W/ ORGANICS (ROOTS) (CH)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 8 oz
~~Full TCLP~~ JH	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SPLIT COLLECTED FOR GUARDIAN TO ANALYZE (LABELED W/ SAME #) SOIL AT SURFACE

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-06~~ (KP 1/6/98) 24-SL0006

Sample I.D. No. 970617 -LD- 24 -SL0006 ~~(0-1')~~ (KP) Coded/Replicate No. MS/MSD + 970617-LD-24-SL9001

Date 6/17/97 Time of Sampling: Begin 1700 End

Weather SUNNY 70's

Site Description 1ST LOCATION N OF SB-05 AS INDICATED IN WORKPLAN

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color MOD BROWN (5YR 3/4) & GRAYISH ORANGE (10YR 7/4) MOTTLED Odor –

Description CLAY, STIFF, COHESIVE, W/ SOME PEBBLE SIZED ROCK (L.S.) (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~ JH	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non-VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SOIL LOCATED UNDER 8" OF FLU DUST

Sampler(s) J. Hughes/David Page

Southpoint 89 1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-07~~ KP 1/6/98 24-SL0007

Sample I.D. No. 970617 -LD-24 -SL0007 ~~(0-1')~~ KP Coded/Replicate No. -

Date 6/17/97 Time of Sampling: Begin 1740 End

Weather Sunny 70's W-N WIND 0-5MPH

Site Description 2ND SOIL BORING N OF SB05, ± 1FT ABOVE DRAINAGE DITCH

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content SATURATE

Color VERY PALE ORANGE (10YR 8/2) Odor CHEMICAL

Description CLAY TO VERY SANDY CLAY, PLASTIC, W/ A FEW BLOBS OF BLACK "TARLIKE" MATERIAL W/ CHEMICAL ODOR (CH)

Analyses Required	Container Description: From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~ JLT

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's MIXED ~~Composited~~ in stainless steel bowl with stainless steel spoon

SOIL LOCATED BENEATH ± 1FT OF FLUDUST

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-08~~ 24-SL0008 KB 1/6/98

Sample I.D. No. 970618 -LD- 24 -SL0008 ~~(0-1')~~ KB Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 955 End

Weather CLOUDY, 80's, N WIND

Site Description E SIDE OF DITCH FROM PROPOSED LOCATION

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth ~~(0-1)~~ (5-12.5/6) (5-12.5/4) Moisture Content MOIST

Color LIGHT BROWN TO MED BROWN MOTTLED Odor —

Description CLAY, STIFF, w/ORGANICS (ROOTS) CCL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full ~~TC~~LP	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~composited~~ MIXED in stainless steel bowl with stainless steel spoon

SOIL AT SURFACE

Sampler(s) J. Hughes/David Page

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-09~~ 1/6/98 24-SL0009

Sample I.D. No. 970618 -LD- 24 -SL0009 ~~(0-1')~~ Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 1010 End

Weather OVERCAST 80's

Site Description E SIDE OF DITCH FROM PROPOSED LOCATION

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color 5YR 5/6 LIGHT BROWN & 5YR 3/4 MOD BROWN MOTTLED Odor —

Description CLAY, STIFF, w/ORGANICS (ROOTS) (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

CONC AT SURFACE

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL — Location Name ~~SB-10~~ 24-SL0010 (KH 1/6/98)

Sample I.D. No. 970618-LD-24-SL0010 ~~(0-1')~~ (KH) — Coded/Replicate No. —

Date 6/18/97 — Time of Sampling: Begin 1010 End

Weather OVERCAST 80's

Site Description E SIDE OF DITCH FROM PROPOSED LOCATION

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth ~~(0-1)~~ — Moisture Content —

Color (5YR2/2) DARK BROWN & LIGHT BROWN (5YR5/6) (CLAY) — Odor —

Description CLAY, PLASTIC, BROWN SOIL (SILTY SAND) (CH)

Analyses Required	Container Description (From Lab X or G&M)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SPL AT SURFACE

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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1/6/98 (?)

Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-11~~ 24-SL0011

Sample I.D. No. 970618 -LD-24 -SL0011 ~~(0-1)~~ (?) Coded/Replicate No. SPLIT W/ GUARDIAN 970618-LD-~~24~~-SL0011

Date 6/18/97 Time of Sampling: Begin 1115 End

Weather SUNNY TO OVERCAST, W. WIND, 0-5mph, 80's

Site Description S. SIDE OF ROAD AS PROPOSED

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) 5YR5/6 5YR3/4 Moisture Content DRY

Color LIGHT BROWN & MOD BROWN MOTTLED Odor —

Description CLAY, VERY STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

SOIL LOCATED UNDER 18" OF FLUE DUST

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-12~~ (KT) 1/6/98 24-SL0012

Sample I.D. No. 970618 -LD- 24 -SL 0012 (0-1')(KT) Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 1145 End

Weather OVERCAST 80'S

Site Description S. SIDE OF ROAD AS PROPOSED ADJACENT TO FLUE PILE

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content DRY

Color (5YR 5/6) - (5YR 3/4) LIGHT BROWN & MOD BROWN MOTTLED Odor —

Description CLAY, VERY STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TC~~LP	~~2 x 8 oz~~ 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SOIL UNDER 2FT OF FLUE DUST

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-15~~ 24-SL0013 (EP 1/6/98)

Sample I.D. No. 970618-LD-24-SL0013 ~~(0-1')~~ (EP) Coded/Replicate No.

Date 6/18/97 Time of Sampling: Begin 1540 End

Weather SUNNY, 90's, HUMID

Site Description DOWN HILL TO WEST OF P-2B & EDGE OF LIME PILE

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color MOD BROWN (5YR 4/4 Odor —

Description CLAY, STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	~~2 x 8 oz~~

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

SOIL AT SURFACE

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 13 of 15

Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-14~~ 24-SL0014 (K) 1/6/98

Sample I.D. No. 97061B -LD-24 -SL0014 ~~(0-1)~~ (K) Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 1520 End

Weather SUNNY

Site Description JUST WEST OF EDGE OF LIME MOUNDS

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color PALE YELLOWISH BROWN (10YR 6/2) Odor —

Description CLAY, W/SOME SAND, & ROCKS (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	~~2 x 8 oz~~

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

SMC AT SURFACE

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-15~~ 24-SL0015

Sample I.D. No. 970618 -LD-24 -SL0015 ~~LD-14~~ Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 14:15 End

Weather Sunny 80's & Wind

Site Description S Side of Road, ± 50 FT North of Proposed Location

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content Dry

Color (10YR7/4) (5YR 2/2) Grayish Orange & Dusky Brown Mottling Odor —

Description Clay, Stiff (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~	~~2 x 8 oz~~ pH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ Mixed in stainless steel bowl with stainless steel spoon

Soil At Surface

Sampler(s) J. Hughes/David Page

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GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SB-15~~ 24-SL0016 KT 1/6/98

Sample I.D. No. 970618 -LD- 24 -SL0016 ~~(0-1')~~ Coded/Replicate No. —

Date 6/18/97 Time of Sampling: Begin 1315 End

Weather SUNNY, 80's, HUMID

Site Description E SIDE OF ROAD APPROX 100' FROM Y IN ROAD

SAMPLING DATA

Collection Method Stainless Steel Hand Auger

Depth (0-1) Moisture Content MOIST

Color MOD BROWN 5YR 3/4 Odor —

Description SOIL, SAND + CLAY (CL - SC)

Analyses Required	Container Description
	From Lab X or-G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
~~Full TCLP~~ JH	~~2 x 8 oz~~ JH

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SOIL AT SURFACE

Sampler(s) J. Hughes/David Page

VOLUME I

APPENDIX A.2

SLUDGE SAMPLING

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 1 of 4

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM 0+~~ 23-SM0001 KT 1/6/98.

Sample I.D. No. 970619 -LD- 23-SM0001 ~~(0-1')~~ Coded/Replicate No. 970619-LD-23-SM9001 970619-LD-23-SM000 + SPLIT W/GUARDIAN (COMP.)

Date 6/19/97 Time of Sampling: Begin ______ End ______

Weather SUNNY, 90's HUMID

Site Description NE QUADRANT OF SWMU 23

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content MOIST

Color BLACK (N1) & MOD BROWN (5YR 4/4) MOTTLED Odor SEPTIC

Description SLUDGE

Analyses Required	Container Description (From Lab X or G&M ____)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1L

Sample Monitoring (TIP, OVA, HNU, etc.) ______

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
SPLIT W/GUARDIAN COLLECTED.

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TFQ320.015 Page 2 of 4

Site Location Sloss Industries, Birmingham, AL Location Name 23- SM~~000~~2 (initials) 11/6/98

Sample I.D. No. 970619-LD-23-SM0002 ~~(0-1')~~ Coded/Replicate No. –

Date 6/19/97 Time of Sampling: Begin 1530 End

Weather Sunny, 90's Humid

Site Description : SE QUADRANT OF SWMU 23

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content SATURATED

Color BLACK (N1) Odor SEPTIC

Description SLUDGE

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 3 of 4

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-09~~ 23-SM0003 1/6/98

Sample I.D. No. 970619 -LD- 23SM0003 ~~(0-1')~~ Coded/Replicate No. —

Date 6/19/97 Time of Sampling: Begin 1555 End

Weather SUNNY 90'S

Site Description NW QUADRANT OF SWMU 22

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content SATURATED

Color MOD BROWN (5YR 3/4) Odor SEPTIC

Description SLUDGE

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	1 x ~~8 oz~~ LITER 2X4oz (VOCs)

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

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GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-04~~ 23-SM0004 KP 1/6/98

Sample I.D. No. 970619 -LD- 23-SM0004 ~~(0-1')~~ KP Coded/Replicate No. —

Date 6/19/97 Time of Sampling: Begin 1605 End –

Weather SUNNY 90's

Site Description SW QUADRANT OF SWMU 23

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content SATURATED

Color BLACK (N1) Odor SEPTIC

Description SLUDGE

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x 4 oz (VOC's) + 1 x LITER (TOTAL)

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 1 of 4

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-OT~~ (KT 1/6/98) 24-SM0001

Sample I.D. No. 970619 -LD-24 -SM0001 ~~(0-1')~~ (KT) Coded/Replicate No. 970619-LD-24-SM9001 SPLIT W/[illegible]

Date 6/19/97 Time of Sampling: Begin 1050 End

Weather SUNNY, 90'S

Site Description NW QUADRANT OF SWMU 2d

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color DUSKY BROWN (5YR 2/2) Odor —

Description FINE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x ~~8~~ 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 8 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-02~~ 24-SM0002 KT 1/6/98

Sample I.D. No. 970619-LD-24-SM0002 ~~(0-1)~~ KD Coded/Replicate No. —

Date 6/19/97 Time of Sampling: Begin 1120 End

Weather SUNNY 80's

Site Description SW QUADRANT OF SWMU 2d

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color DUSKY BROWN (5YR2/2) Odor —

Description FINE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-10

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name 24-SM0003 (initials) 1/6/98

Sample I.D. No. 970619 -LD-24 -SM0003 ~~(0-1')~~ Coded/Replicate No. —

Date 6/19/97 Time of Sampling: Begin 1145 End

Weather SUNNY 90'S

Site Description SE QUADRANT OF SWMU 24

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color DUSKY BROWN (5YR 2/2) Odor —

Description FLUE DUST

Analyses Required	Container Description (From Lab X or G&M)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name 24- SM-0004 1/16/98

Sample I.D. No. 970619 -LD-24 -SM0004 ~~10-1~~ Coded/Replicate No.

Date 6/19/97 Time of Sampling: Begin 1235 End

Weather SUNNY ~~OVERCAST~~ 90's

Site Description NE QUADRANT OF YWMU 29

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content MOIST

Color DUSKY BROWN (5YR2(2) Odor —

Description FINE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 1/6/98 Page 1 of 6

Site Location Sloss Industries, Birmingham, AL Location Name KT 39-SM0001 ~~SM-01~~

970616-LD-39-EB0001
970616-LD-39-FB0001

Sample I.D. No. 970616-LD-39-SM0001 ~~(0-1')~~ Coded/Replicate No.

Date 6/16/97 Time of Sampling: Begin 1620 End

Weather SUNNY → OVERCAST, 80's, 5 WIND

Site Description S END OF SWMU 39 FROM BOTTOM 1/3 OF PILE

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content MOIST

Color very dusky red 10R 2/2 Odor —

Description Fine grained material w/some medium grained material "iron" like particles present

Analyses Required	Container Description From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ /L

NOT ANALYZED BY LAB JH 12/15/97

Sample Monitoring (TIP, OVA, HNU, etc.) —

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
EB & FB COLLECTED w/ SUPERBRAND SODIUM FREE DISTILLED H_2O LOT # DNOV 997

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 6

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-02~~ 39-SM0002 KH 1/6/98

Sample I.D. No. 970616-LD-39-SM0002 ~~(0-1')~~ Coded/Replicate No. —

Date 6/16/97 Time of Sampling: Begin 1025 End

Weather SUNNY, 70's, LIGHT WIND FROM SOUTH

Site Description WEST SIDE OF SWMU 39, ± 1/2 WAY UP PILE, ± 1/3 WAY UP FROM S END OF SWMU 39

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color VERY DUSKY RED 10R 2/2 Odor —

Description FLUE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-03~~ ~~11ct18~~ 39-SM0003 970616-LD-39-SM9001

Sample I.D. No. 970616-LD-39-SM0003 ~~(0-1')~~ Coded/Replicate No. —

Date 6/16/97 Time of Sampling: Begin 1700 End

Weather OVERCAST 80's, SWIND

Site Description E SIDE OF SWMU 39 ABOUT 3/4 WAY UP FROM SOUTHERN END

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color very dusky red (10R 2/2) Odor —

Description Fine to medium grained material, hard, w/ some silver colored particles in it

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 4 oz
Full TCLP	2 x ~~8 oz~~ 1L

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon
DUPLICATE OF 39 COLLECTED

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 4 of 6

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-01~~ 39-SM0004 KH 1/6/98

Sample I.D. No. 970616 -LD- 39 -SM0004 ~~(0-1')~~ KH Coded/Replicate No. —

Date 6/16/97 Time of Sampling: Begin 1800 End

Weather OVERCAST, 70's, NO WIND

Site Description N END OF SWMU 39. COLLECTED ± 1/3 UP FROM BOTTOM OF PILE

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color VERY DUSKY RED (10 YR 2/2) Odor —

Description FINE TO MED. GRAINED, MED HARD,

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 4 oz
SVOCs (8270)	1 x 4 oz
Cyanide (9010)	1 x 8 oz
Full TCLP	2 x ~~8 oz~~ 1 LITER

NOT ANALYZED BY LAB JH 12/19/97

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 5 of 6

Site Location Sloss Industries, Birmingham, AL Location Name ~~SM-05~~ 39-SM0005 ET 1/6/98

Sample I.D. No. 970619-LD-39-SM0005 ~~(0-1+)~~ Coded/Replicate No.

Date 6/19/97 Time of Sampling: Begin 1710 End

Weather Sunny

Site Description APPROXIMATELY 1/3 OF WAY FROM N END OF SWMU 39. ON WEST SIDE OF SWMU 39. ± 5FT UP BANK FROM ROAD CUT IN FOR PIPELINE

SAMPLING DATA

Collection Method Stainless Steel Spoon

Depth NA Moisture Content DRY

Color VERY DUSKY RED (10R 2/2) Odor —

Description FLUEDUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz
Full TCLP	2 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's ~~Composited~~ MIXED in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes/David Page

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 6 of 6

Site Location SLOSS INDUSTRIES, BIRMINGHAM, AL LOCATION NAME: 39- SM0006 RC 1/6/98

Sample I.D. No. 970619-LO-39-SM0006 Coded/Replicate No. —

Date 6/19/97 Time of Sampling: Begin 1735 End

Weather SUNNY 80's

Site Description APPROX. 1/3 LENGTH OF SWMU 39 N OF ACCESS ROAD AT MW-34S&D HEADING DOWN ACCESS ROAD. ON WEST SIDE OF PILE APPROX 5 TO 10 FT UP BANK

SAMPLING DATA

Collection Method STAINLESS STEEL SPOON

Depth NA Moisture Content DRY

Color VERY DUSKY RED (10R 2/2) Odor —

Description FLUE DUST

Analyses Required	Container Description (From Lab X or G&M)
PRIORITY POLLUTANT METALS & BARIUM (6010 & 7471)	1 x 4 oz GLASS
VOCs (8260)	1 x 8 oz GLASS
SVOCs (8270)	1 x 8 oz GLASS
CYANIDE (9010)	1 x 8 oz GLASS
FULL TCLP	2 x 8 oz GLASS

Sample Monitoring (TIP, OVA, HNU, etc.) —

Remarks NON VOC'S MIXED IN STAINLESS STEEL BOWL W/STAINLESS STEEL SPOON

Sampler(s) J. HUGHES / D. PAGE

VOLUME I

APPENDIX A.3

SUBSURFACE SOIL SAMPLING

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 1 of 2

Site Location Sloss Industries, Birmingham, AL Location Name: MW-21

Sample I.D. No. 970806 -LD- 23 -SL0021 (14-16) Coded/Replicate No. —

Date 8/6/97 Time of Sampling: Begin 1445 End

Weather SUNNY 80's

Site Description AT MW-21, JUST BELOW STEEP CHANGE IN SLOPE

SAMPLING DATA

Collection Method Split spoon

Depth 14-16 Moisture Content MOIST

Color LIGHT BROWN (5YR 6/4) Odor —

Description CLAY, slightly plastic (CL)

Analyses Required	Container Description (From Lab X or G&M)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 2

Site Location Sloss Industries, Birmingham, AL Location Name: MW-21

Sample I.D. No. 970806 -LD-23 -SL0021 (20-22) Coded/Replicate No. 970806-LD-23-SL9021

Date 8/6/97 Time of Sampling: Begin 1430 End

Weather SUNNY, 80's

Site Description AT MW-21, JUST BELOW STEEP CHANGE IN SLOPE

SAMPLING DATA

Collection Method Split spoon:

Depth 20-22 Moisture Content MOIST

Color LIGHT BROWN (5YR 5/6) Odor –

Description CLAY, STIFF, w/some laminations like original bedding(?) (CL)

Analyses Required

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM-ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 23-SBMW-22 (KF) 1/6/98

Sample I.D. No. 970806 -LD- 23 -SL0022 (0-2) Coded/Replicate No. ~

Date 8/ 6 /97 Time of Sampling: Begin 740 End

Weather SUNNY HIGH 70'S TO LOW 80'S

Site Description AT MW-27

SAMPLING DATA

Collection Method Split spoon

Depth 0-2 Moisture Content DRY

Color DUSKY BROWN (5YR 2/2) + LIGHT BROWN (5YR 5/6) Odor ~

Description CLAY w/ CHERT & SANDSTONE (CL)

Analyses Required	Container Description
	From Lab X , or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

8/6/97. SANDSTONE PRESENT AT 2 FT BGS

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 23-SBMW23 KH 1/6/98

Sample I.D. No. 9708 ~~95~~ -LD- 23 SL 0023 (12-14) Coded/Replicate No. —

Date 8/6/97 Time of Sampling: Begin 930 End

Weather Sunny 80's

Site Description At MW-23

SAMPLING DATA

Collection Method Split spoon

Depth 12-14 Moisture Content Dry

Color Light brown (5YR 5/6) w/ very pale orange (10YR 8/2) Odor —

Description Clay stiff (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 23-SB ~~MW-23~~ (KF) 1/6/98

Sample I.D. No. 970808 -LD- 23 -SL 0023 (24-26) Coded/Replicate No. —

Date 8/6/97 Time of Sampling: Begin 1020 End

Weather Sunny 80's

Site Description At MW-23

SAMPLING DATA

Collection Method Split spoon

Depth 24-26 Moisture Content Moist to dry

Color Light brown 5YR 6/4 w/ dusk brown 5YR 2/2 laminations Odor —

Description Clay, plastic to stiff, has layered look like originally bedrock (CL-CH)

Analyses Required	Container Description: From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL (KT 9/17/97) Location Name: 23-SB MW24 KT 1/6/98

Sample I.D. No. 970805 -LD- 23 -SL 0024 (~~6-8~~ 7-9) Coded/Replicate No. 970805-LD-23-SL0024 (7-9) MS/MSD

Date 8/05/97 Time of Sampling: Begin 1515 End

Weather Sunny 80's

Site Description At MW-24

SAMPLING DATA

Collection Method Split spoon.

Depth ~~7~~-8 Moisture Content MOIST

Color MOD BROWN 5YR 4/4 w/ LIGHT BROWN 5YR 5/6 Odor —

Description CLAY, STIFF, w/ CHERT FRAGMENTS (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

5/4/10 | 19

Sampler(s) J. Hughes

Southprint 89-1093

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 23-SB MW 24 (KT) 1/6/98

Sample I.D. No. 970805 -LD-23 -SL 00 24 (14-16) Coded/Replicate No. –

Date 8/5/97 Time of Sampling: Begin 1550 End

Weather Sunny 80's

Site Description AT MW-24

SAMPLING DATA

Collection Method Split spoon

Depth 14-16 Moisture Content MOIST

Color LIGHT BROWN 5YR5/6 Odor –

Description CLAY, STIFF, w/ ~~SILT~~ CHERT FRAGMENTS (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 23-SBMW-25 KF 1/6/98

Sample I.D. No. 970805-LD-23-SL0025 (19-21) Coded/Replicate No. ______

Date 8/5/97 Time of Sampling: Begin 1345 End ______

Weather Sunny 80's

Site Description At MW-25 ±5 FT EAST OF CENTER OF WELL PAIR

SAMPLING DATA

Collection Method Split spoon

Depth 19 - 21 Moisture Content DRY

Color PALE OLIVE (10Y 6/2) w/ MOD YELLOWISH BROWN (10YR 5/4) MOTTLING Odor —

Description CLAY (CL)

Analyses Required	Container Description
	From Lab X or G&M ______
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.) ______

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW 26 1/6/98

Sample I.D. No. 970804 -LD-38 -SL0026 (10-12) 10-23-97 Coded/Replicate No. 970804-LD-38-SL0026

Date 8/04/97 Time of Sampling: Begin 1540 End

Weather Sunny 90's

Site Description AT MW-26

SAMPLING DATA

Collection Method Split spoon

Depth 10-12 Moisture Content DRY

Color MOD yellowish brown (10YR 5/4) + MOD Brown 5YR 4/4 + Light brownish Gray (5YR 6/1) Odor

Description CLAY, Stiff (CL)

Analyses Required / Container Description

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

10/15/15/1%

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 2

Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW 26 1/6/98

Sample I.D. No. 970804 -LD- 38 -SL 0026 (18-20) 10-23-97 Coded/Replicate No.

Date 8/ 04/97 Time of Sampling: Begin ~~1415~~ 1615 End

Weather Sunny 90's

Site Description At MW-26

SAMPLING DATA

Collection Method Split spoon:

Depth ~~20-22~~ 18-20 Moisture Content DRY

Color Mod Yellowish Brown (10YR 5/4) + Dusky Brown (5YR 2/2) Odor None

Description CLAY, STIFF, w/ some calcite & L.S (fine gr recrystallized) fragments (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

43/32 | 27/20

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW-27 KD 1/6/98

Sample I.D. No. 9708 05 -LD- 38 -SL0027 (11-13) Coded/Replicate No. –

Date 8/ 5 /97 Time of Sampling: Begin 800 End

Weather Sunny 70's

Site Description At MW-27

SAMPLING DATA

Collection Method Split spoon

Depth 11-13 Moisture Content ~~Plas.~~ Moist → Dry

Color Light Brown (5YR 5/6) w/ Dusky Red (5R 3/4) Mottling Odor –

Description Clay, w/ Iron Concretions, Plastic to Stiff (CL)

Analyses Required

Container Description

From Lab X or G&M

Analyses Required	Container Description
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW-27 (KJ) 1/6/98

Sample I.D. No. 970805-LD-38-SL0027 (22-24) Coded/Replicate No. —

Date 8/5/97 Time of Sampling: Begin 8:5 End

Weather Sunny 70's

Site Description At MW-27

SAMPLING DATA

Collection Method Split spoon

Depth 22-24 Moisture Content Moist to saturated

Color Pale yellowish brown (10YR 6/2) Odor —

Description CLAY, plastic, w/ limestone fragments (CH)

Saturated at bottom of spoon

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

1/46/50 18" recovery

Sampler(s) J. Hughes

Southprint 89-1093

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SBMW-28 KB 1/6/98

Sample I.D. No. 970807-LD-38-SL0028 (8-10) Coded/Replicate No. 970807-LD-38-SL0028(8-10) MS/MSD

Date 8/7/97 Time of Sampling: Begin 1420 End

Weather SUNNY 80's

Site Description AT MW-28 ± 5FT SOUTH OF WELL

SAMPLING DATA

Collection Method Split spoon

Depth 8-10 Moisture Content MOIST

Color 10YR7/4 GRAYISH ORANGE w/ 5YR5/6 LIGHT BROWN & 5YR2/2 DUSKY BROWN MOTTLING Odor —

Description CLAY, stiff, (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

6/6/8/11 10/10/12/14

Sampler(s) J. Hughes

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name 38-SB MW-28 (KA) 1/6/98

Sample I.D. No. 970807 -LD- 38 -SL 0028 (13-15) Coded/Replicate No. —

Date 8/7/97 Time of Sampling: Begin 1625 End

Weather Sunny 80's

Site Description At MW-28 ± 5 Ft South of Well

SAMPLING DATA

Collection Method Split spoon

Depth 13-15 Moisture Content Moist

Color Light Greenish Gray (5GY8/1), Light Brown (5YR5/6) & Brown Mottled (5YR3/4) Odor —

Description Clay, Plastic to Stiff (CL-CH)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SBMW 29 KJ 1/6/98

Sample I.D. No. 970807 -LD- 38 -SL 0029 (15-17) Coded/Replicate No. —

Date 8/7/97 Time of Sampling: Begin 1220 End

Weather SUNNY 80's

Site Description 1/2 WAY BETWEEN MW-30 & MW-28 ON SIDE ACCESS ROAD NEXT TO FENCE

SAMPLING DATA

Collection Method Split spoon

Depth 15-17 Moisture Content moist

Color light brown (5YR 5/6) Odor —

Description CLAY, silt (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

OVM - ND 11/12/14/15

Sampler(s) J. Hughes

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW29 (KD) 1/6/98

Sample I.D. No. 970807 -LD- 38 -SL 0029 (19-21) Coded/Replicate No. —

Date 8/7/97 Time of Sampling: Begin 1230 End

Weather Sunny 80's

Site Description 1/2 WAY BETWEEN MW-30 & MW-28 ON SIDE ACCESS ROAD NEXT TO FENCE

SAMPLING DATA

Collection Method Split spoon

Depth 19-21 Moisture Content Moist

Color light brown (5YR5/6) w/ some med brown (5YR4/4) mottling Odor —

Description CLAY, stiff (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

9/7/7/10

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 38-SB MW-30 S¦D

Sample I.D. No. 970807-LD-38-SL 0030 (9-11) Coded/Replicate No. —

Date 8/7/97 Time of Sampling: Begin 915 End

Weather

Site Description AT MW-30 S¦D ±5 FT E of PAIR

SAMPLING DATA

Collection Method Split spoon

Depth 9-11 Moisture Content Dry

Color LIGHT BROWN 5 YR 5/6 Odor —

Description CLAY, STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM-ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

10/6/10/14

Sampler(s) J. Hughes

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SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL

Location Name: ~~3B~~ 3C - SB MW-30 S&D

Sample I.D. No. 970807 -LD- 3B -SL0030 (~~18-19~~) 17-19 (JH)

Coded/Replicate No.

Date 8/7/97

Time of Sampling: Begin 1000 End

Weather SUNNY 80'S

Site Description AT MWS-30 ± 5 FT EAST OF PAIR

SAMPLING DATA

Collection Method Split spoon.

Depth ~~18-20 JH~~ 17-19

Moisture Content MOIST

Color LIGHT BROWN 5YR5/6

Odor —

Description CLAY, STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

9/4/90

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL / SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 39-SB MW-32 (K+) 1/6/98

Sample I.D. No. 970805-LD-39 -SL0032 (20-22) Coded/Replicate No. 970805-LD-39-SL9032

Date 8/5/97 Time of Sampling: Begin ____ End ____

Weather Sunny 80's

Site Description AT MW-32

SAMPLING DATA

Collection Method Split spoon

Depth ____ Moisture Content ____

Color ____ Odor ____

Description ____

NO SAMPLE COLLECTED
ONLY NON-NATIVE MATERIALS PRESENT

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

NO SAMPLE COLLECTED

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: MW-33

Sample I.D. No. 970808 -LD-39 -SL 0033 (11-13) Coded/Replicate No.

Date 8/8/97 Time of Sampling: Begin 1525 End

Weather Overcast, 70's, drizzle to med rain

Site Description 1/2 WAY BETWEEN MW-32 & MW-34 ON WEST SIDE OF ROAD ON EAST SIDE OF SWMW39.

SAMPLING DATA

Collection Method Split spoon

Depth 11-13 Moisture Content DRY

Color 5Y6/3, 10 Y 6/2 LIGHT BROWN & PALE OLIVE Odor —

Description CLAY, STIFF, w/ROUNDED PEBBLES (CL)

Analyses Required

Priority Pollutant Metals & Barium (6010 & 7471)

VOCs (8260)

SVOCs (8270)

Cyanide (9010)

Container Description

From Lab X or G&M

1 x 4 oz

1 x 8 oz

1 x 8 oz

1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM-ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: 39-SB ~~MW-34~~ KT 1/6/98

Sample I.D. No. 970805 -LD- 39 -SL 0034(10-12) KT 10-23-97 Coded/Replicate No. —

Date 8/5/97 Time of Sampling: Begin 1200 End

Weather Sunny 80's

Site Description At MW-34 ± 5 Ft N of MW-34 D

SAMPLING DATA

Collection Method Split spoon

Depth 10-12 Moisture Content Moist

Color olive gray 5Y 3/2 Odor —

Description CLAY, STIFF w/ some L.S. FRAGMENTS (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

21-19/11

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: MW-35

Sample I.D. No. 970808 -LD-39 -SL0035 (10-12) Coded/Replicate No. MW-35

Date 8/8/97 Time of Sampling: Begin 1240 End

Weather OVERCAST 70's OCCASIONAL

Site Description AT MW-35 PROPOSED LOCATION. APPROX 1/2 WAY DOWN ACCESS ROAD FROM MW-34S&D.

SAMPLING DATA

Collection Method Split spoon

Depth 10-12 Moisture Content SLIGHTLY MOIST

Color GRAYISH ORANGE (10YR7/4) & LIGHT BROWN (5YR 5/6) MOTTLED Odor —

Description CLAY STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

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Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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KT 1/6/98

Site Location Sloss Industries, Birmingham, AL Location Name: ~~MW-36~~ 39-SBMW36

970804-LD-38-SL9036

Sample I.D. No. 970804 -LD- ~~38~~ 39 -SL0036 (5-7) KT 10-23-97 Coded/Replicate No. 970804-LD-38-SL0036 MS/MSD

Date 8/04/97 Time of Sampling: Begin 1400 End

Weather Sunny 90's

Site Description AT MW-36

SAMPLING DATA

Collection Method Split spoon

Depth 5-7 Moisture Content Moist

Color Mod Brown (5YR 4/4) w/ very dusky red 10YR (2/2) Odor —

Description CLAY, plastic, w/ small rocks (CH)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

.6|8|9

Sampler(s) J. Hughes

Southprint 89-1093

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SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 2

Site Location Sloss Industries, Birmingham, AL Location Name: ~~39-SB~~ MW-36 (KT) 1/6/98

Sample I.D. No. 9708~~04~~ -LD-~~38~~ 39 -SL0036 (10-12) KT 10-23-97 Coded/Replicate No. —

Date 8/~~04~~/97 Time of Sampling: Begin 1930 End

Weather Sunny 90's

Site Description MW-36

SAMPLING DATA

Collection Method Split spoon

Depth 10-12 Moisture Content Moist

Color Mod Brown (5YR 4/4) Odor —

Description Clay, plastic (CH)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

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Site Location Sloss Industries, Birmingham, AL Location Name: MW-37

Sample I.D. No. 970808 -LD-38 -SL0037 (4-6) Coded/Replicate No. SPLIT w/GUARDIAN

Date 8/08/97 Time of Sampling: Begin 1100 End

Weather OVERCAST 70'S OCCASIONAL LIGHT RAIN

Site Description AT SE END OF SWMU 38

SAMPLING DATA

Collection Method Split spoon

Depth 4-6 Moisture Content MOIST

Color LIGHT BROWN w/PALE OLIVE MOTTLING Odor —

Description CLAY, STIFF (CL)

Analyses Required / Container Description

From Lab X or G&M

Analyses Required	Container Description	
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz	1x4oz FOR GUARDIAN
VOCs (8260)	1 x 8 oz	1 LITER GLASS FOR GUARDIAN
SVOCs (8270)	1 x 8 oz	1 LITER GLASS FOR GUARDIAN
Cyanide (9010)	1 x 8 oz	1 LITER GLASS

Sample Monitoring (TIP, OVA, HNU, etc.)

OVM - ND

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 2

Site Location Sloss Industries, Birmingham, AL Location Name: MW-37

Sample I.D. No. 970808 -LD- -SL0037 (8-10) Coded/Replicate No.

Date 8/ 8 /97 Time of Sampling: Begin 1040 End

Weather OVERCAST 70's W/OCCASIONAL LIGHT RAIN

Site Description AT SE END OF SWMW38

SAMPLING DATA

Collection Method Split spoon

Depth 8-10 Moisture Content MOIST

Color GRAYISH ORANGE (10 YR 7/4) W/ PALE OLIVE (10 Y 6/2) & LIGHT BROWN (5 YR 5/6) MOTTLING Odor —

Description CLAY, STIFF (CL)

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

VOLUME I

APPENDIX A.4

MONITOR WELL SAMPLE/CORE LOGS

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well MW-21 Project/No. Sloss Industries / TF0320.015 Page 1 of 2

Site Location Birmingham, AL Drilling Started 8/6/97 Drilling Completed 8/6/97

Total Depth Drilled 24 feet Hole Diameter 6 inches Type of Sample/Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 556.58 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper JOHN/DWIGHT

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	
0	2	1.0	3/12/9	CLAY, mod yellowish brown (10YR5/4) w/ light brown mottling (5YR5/6), stiff, dry, no odor (CL)	ND
2	4	0.25	3/3/3/4	NO RECOVERY/ ~~ev~~ CLAY AS 0-2 (CL)	ND
4	6	2.0	3/3/4/5	CLAY, mod brown 5YR4/4, w/ abundant sand, moist, plastic, no odor (CH)	ND
6	8	2.0	2/9/27/10	CLAY AS ABOVE, w/ SANDSTONE FRAGMENTS DARK YELLOWISH BROWN (10YR4/2) vf gr qtz & qtz sand, moist, no odor (CH)	
8	10	2.0	6/12/16/14	LIME ON TOP OF SPOON ALL ABOVE 8 IS MOST LIKELY FILL. CLAY, light brown (5YR5/6) w/ some light brown 5YR6/4 stiff, no odor (CL)	
10	12	2.0	8/6/9/12	CLAY AS 8 TO 10 (CL)	
12	14	2.0	9/10/11/12	CLAY AS 8 TO 10 (CL)	

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GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG (Cont.d)

Boring/Well MW-21 Page 2 of 2

Prepared By Joe Hughes

	Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	
*	14	16	2.0	4/4/4/4	CLAY AS 8-10	ND
	16	18	2.0	6/6/5/8	CLAY AS 8-10 w/ more light brown 5YR6/4	ND
	18	20	2.0	4/6/3/6	CLAY AS 8-10	ND
*	20	22	2.0	8/10/14/16	CLAY, AS 8-10, w/ some laminations like	ND
					original bedrock	
*	22	24	0.25	18/36/50/3	CLAY, AS 20-22	
8	24	26		50/0	ROCK AT 23.5 CLAY IN TOP OF SPOON & IS	
16					SATURATED - H_2O ON TOP OF ROCK	
14						
					AUGER REFUSAL AT 23.5	

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well PMW-21 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/8/97 Drilling Completed 8/9/97

Total Depth Drilled 42 feet Hole Diameter 10" inches Type of Sample/Coring Device CUTTINGS

Length and Diameter of Coring Device NA Sampling Interval — feet

Land-Surface Elev. 556.58 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used POTABLE H_2O Drilling Method AIR ROTARY / HAMMER

Drilling Contractor Graves Service Company, Inc. Driller JOHN MITCHELL Helper DWIGHT PRUIT

Prepared By Joe Hughes Hammer Weight — Hammer Drop — inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	23.5			SEE HOLLOW STEM AUGER LOG
23.5	28.25	FROM CUTTINGS		LIMESTONE, FRACTURED, HARD
28.25	29.5	ROTARY/AIR		LIMESTONE, MOD HARD, FRACTURED w/ CALCITE FILLED VEINS
29.5	30.25			CLAY w/ LIMESTONE
32	33.75			LIMESTONE, FRACTURED FROM 31.75 TO 32, HARD
33.75	34.75			LIMESTONE, MOD, w/ CLAY
34.75	36.75			LIMESTONE, FRACTURED, HARD
36.75	37.75			LIMESTONE, MEDIUM HARD
37.75	42			LIMESTONE, FRACTURED, HARD
				STOP FOR NIGHT 8/7/97
				TD 42

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GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

MW-22 JH 12/19/97

Boring/Well P-31 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 7-18-95 1200 Drilling Completed 7-18-95 1210

Total Depth Drilled ~2.0 feet Hole Diameter 7 1/4" inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2' x 2" Sampling Interval Continuous feet

Land-Surface Elev. 625.70 feet (KT 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor GRAVES SERVICES Co. Driller Ron Helper Hal

Prepared By J. KIRKPATRICK Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	2		50/0	SANDSTONE, white, fine to medium grained, weathered (friable), poorly cemented, becomes hard at 2 ft bls. (made 3 attempts to penetrate rock. Augered through 2 ft of highly weathered S.S - then had spoon refusal on one attempt - couldn't penetrate rock on other two attempts.)

J. Kirkpatrick 7-18-95

JH 2/19/97

GERAGHTY & MILLER, INC.
Environmental Services

FLW-22 JH 12/19/97

SAMPLE/CORE LOG

Boring/Well ~~P-31~~ Project/No. TF0320-013 Page 1 of 2

Site Location SLOSS, BIRMINGHAM, ALABAMA Drilling Started 7/19/95 Drilling Completed 7/20/95

Total Depth Drilled 114 feet Hole Diameter 6 1/8 inches Type of Sample/Coring Device —

Length and Diameter of Coring Device — Sampling Interval — feet

Land-Surface Elev. 625.70 feet ☒ Surveyed KD 2/6/96 ☐ Estimated Datum MSL

Drilling Fluid Used APPROX. 150 GAL H_2O Drilling Method AIR ROTARY

Drilling Contractor GRAVES Driller JOHN M. Helper JB/DWIGHT P.

Prepared By J. HUGHES Hammer Weight — Hammer Drop — inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	8.5	AIR ROTARY		SAND STONE, LIGHT BROWN (5YR 6/4) HARD-SOFT,
		6" HOLE		W/HEMATITE CMT & CHERT FRAGMENTS (TO 2 FT - FU?), WEATHERED AT SURFACE
				WELL ROUNDED ~~QTZ~~ SND MODERATE SORTING, DRY, VF GR
8.5	9			CLAY, LIGHT BROWN (5YR 6/4), DRY
9	13.5			SANDSTONE AS 0-8.5, HARD
13.5	22.75			CLAY (SANDY), LIGHT BROWN (5YR 6/4) W/TRACE
				SAND STONE AT 14.0-16
22.75	28.5			SANDSTONE STRINGERS, LIGHT BROWN (5YR 6/4), HARD,
				VFGR, HEMATITE CMT, IN CLAY MATRIX, LIGHT
				BROWN (5YR 6/4), HARD, DRY
28.5	36			SHALE (CLAYEY), LIGHT GRAY (N7), NON FISSLE,
				SLIGHTLY DAMP, SOME LIGHT BROWN (5YR 6/4) SHALE/CLAY
				& LIGHT BROWNISH GRAY SHALE CLAY (5YR 6/1)
				S.S. STRINGER AT 34.75-35
36	72			SHALE/CLAY, MEDIUM GRAY (N5), HARD, SLIGHTLY
				FISSLE, SLIGHTLY MOIST
				SOFT SPOT 52.5-52.75
72	72.5			BLACK SILT (LIKE COAL)
72.5	76	AIR ROTARY		SHALE, AS 36-72
		6"		

~~000165~~ JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~R3+~~ MW-22 JH 12/19/97 Project/No. TF0322.013 Page 2 of 2

Site Location Sloss-Birmingham, Alabama Drilling Started 7/19/95 Drilling Completed 7/2-/95

Total Depth Drilled 119 feet Hole Diameter 6 1/0 inches Type of Sample/Coring Device —

Length and Diameter of Coring Device ___ Sampling Interval — feet

Land-Surface Elev. 625.70 feet ☒ Surveyed ☐ Estimated Datum MSL KB 2/6/96

Drilling Fluid Used Approx 150 Gal H_2O Drilling Method Air Rotary

Drilling Contractor Graves Driller John M Helper JB/Dwight P.

Prepared By J. Hughes Hammer Weight — Hammer Drop — inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
76	83	Air Rotary		Clay (Shale, light brown (5YR 6/4), hard, dry
83	102	6"		Sandstone, moderate brown (5YR 4/4), vf-fn Gr
				Qtz sand, mod rounded & sorted, hematite cement
				w/ clay as 76-83, dry
				Soft spot 86.75 – 88.25
102	104.5			Siltstone ~~to~~ sandstone, moderate brown (5YR 4/4)
				≤ vf-f Gr Qtz sand, moderate rounded & sorted,
				hematite cement, w/ minor limestone w/ coarse
				calcite filling burrows/casts or intraclasts.
104.5	109.5			Limestone, medium gray (N5), hard w/ fractures (107-108)
				w/ calcite filled veins & some siltstone/sandstone (brown)
109.5	112			Clay, soft, w/ hard stringer at 111.5
113	114.5			Shale/clay, med gray (N5), non fissile
114.5	119	Air Rotary		Limestone, medium gray (N5), w/ calcite filled
		6"		veins/fractures, hard, fractured in spots (?)
				Fossils: branching bryozoan; crinoid stem; colonies (50.5mm)
				*After drilling to 119 ft bls & letting bore hole
				set for 15 min DTW = ±108 ft bls
				Possible water bearing zones at 107-109 & 114.5-119
				Screened to 109.5 Sand to 10[illegible]

JH 12/19/97

000100

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~P-30~~ MW-23 SH 12/19/97 Project/No. TF0820013 SLOSS INDUSTRIES Page 1 of 2

Site Location BIRMINGHAM ALABAMA Drilling Started 7-18-95 1515 Drilling Completed ~~7-18-95~~ 7-17-95 0930 JWK 7-17-95

Total Depth Drilled 38 feet Hole Diameter 7¼ inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2' x 2" Sampling Interval Continuous feet

Land-Surface Elev. 632.94 feet (KT 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor GRAVES SERVICE Co. Driller Ron Helper Hal

Prepared By J. KIRKPATRICK Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	OVM
0	2	24"	12/13/14/15	CLAY, mottled mod. reddish brown (10 R 4/6) and pale yellowish orange (10 YR 8/6), stiff, dry, no odor (CH)	0.0
2	4	18"	12/21/19/18	CLAY, pale yellowish orange (10 YR 6/6) w/ mod. reddish brown streaks, dry, stiff, no odor. (CH)	0.0
4	6	22"	16/21/22/25	CLAY, w/ silt, pale yellowish orange (10 YR 8/6) w/ mod. reddish lenses, dry to damp, hard but breaks apart. Some highly weathered S.S. (fine grain), no odor (ML)	0.0
6	8	22"	28/30/28/24	CLAY, silty, pale yellowish orange (10 YR 8/6), hard but crumbles easily, dry, no odor. (ML) or (CL)	0.0
8	10	24"	4/4/5/7	CLAY, Silty, pale yellowish orange (10 YR 8/6) w/ mod. reddish brown (10 R 4/6) streaks, medium stiff, crumbles easily, damp, no odor (ML) or (CL)	0.0
10	12	22"	6/10/12/14	CLAY, some silt, "marbled appearance" – pale yellow orange and light gray (N7), medium stiff, cohesive, damp, no odor. (CL)	0.0
12	14	20"	10/18/17/25	CLAY, pale yellowish orange (10 YR 8/6) and thin mod. reddish orange streaks, looks like weathered Lime	0.0

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG (Cont.d)

Boring/Well ~~P-30~~ MW-23 JH 12/19/92

Page 2 of 2

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
				stone (but the ~~[illegible]~~ color's wrong), medium stiff to	
				stiff, damp to dry, no odor (CL)	
14	16	24"	5/6/12/10	CLAY, silty, pale yellowish orange + light gray	0.0
				color, stiff, dry, no odor.	
				(CL)	
16	18	11"	4/14/21/28	CLAY, as above. (CL)	0.0
18	20	24"	8/18/25/22	CLAY, silty and ~~[illegible]~~ fine sand, pale yellowish orange	0.0
				(10 YR 6/6) w/ black (Mn) streaks (3" zone in middle)	
				stiff, damp to dry, no odor. (CL)	
20	22	0"	13/26/27/25	No recovery - lost shoe on spoon.	NA
22	24	24"	2/8/10/10	CLAY, dark yellowish orange (10YR 6/6) w/ light brown	0.0
				(5 YR 5/6) streaks, thinly bedded, (vertically), med.	
				stiff, damp, no odor (OH)	
24	26	22"	8/10/11/12	CLAY, pale yellow orange (10 YR 8/6) and dark yellow orange (10 YR 6/6)	0.0
				thinly bedded (vertical), medium stiff, damp	
			soft refusal	no odor. (OH)	
26	28	18"	6/19/50/5"	CLAY, shades of yellowish and reddish orange,	0.0
				some bedding (vertical), med. stiff to hard, damp	-
			refusal	to dry, no odor (OH)	
28	30	9"	21/50/3"	CLAY, mod. reddish brown (10 R 4/6), some very	0.0
				pale orange (10 YR 8/2), some bedding, (vertical)	
				very stiff to hard, dry, no odor. (OH)	
				some "shale like" fragments in cuttings	

SPOON REFUSAL - 27.0 and 28.5.

NO AUGER REFUSAL (DOWN TO 32' bls VERY HARD)

G&M Form 04 6-86

GERAGHTY & MILLER, INC.
Environmental Services

SH 12/19/97

SAMPLE/CORE LOG

Boring/Well ~~P-30~~ MW-23 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 7-27-95 0800 Drilling Completed 7-27-95 1045

Total Depth Drilled 79.0 feet Hole Diameter 6" inches Type of Sample/Coring Device None

Length and Diameter of Coring Device 2' x 2" Sampling Interval None feet

Land-Surface Elev. 632.94 feet KT 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR ROTARY

Drilling Contractor GRAVES SERVICE CO. Driller DWIGHT PRUITT Helper J. BUTLER

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	30			SEE LITHOLOGY LOG FOR HSA O.B. DRILLING.
				Reddish brown clay and weathered shale.
30	38	AIR ROTARY		CLAY (possibly highly weathered shale), mod. reddish
		6" Roller Cone		brown (10 R 4/6), dry. Easy drilling
38	53			CLAY OR SHALE (highly weathered), some evidence of thin
				bedding, medium gray (N5), dry to damp. Smooth drilling
53	55			CLAY or SHALE, (highly weathered), ~~pale~~ grayish
				orange (10 YR 7/4), bit is cutting smoothly
55	57			SANDSTONE, weathered, light brown (5 YR 5/6)
				well rounded, hard, medium to fine grained.
57	79			SHALE (or CLAY), medium gray (N5), weathered
				smooth drilling but hit an occasional hard spot (<1'
				thick) throughout formation. Hard spots are
				SANDSTONE, fine grained, medium gray, hard and
				SHALE, hard, medium gray. Making water at ~76 ft
		79 —	TOTAL	DEPTH bls. (~1 gpm or better)
				[signature] 7-27-95

G&M Form 03 6-86

~~000163~~ SH 12/19/97

Southprint 89-1257

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

MW-24 JH 12/19/97

Boring/Well ~~P-29~~ MW-24 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 2

Site Location BIRMINGHAM ALABAMA Drilling Started 7-18-95 0815 Drilling Completed 7-18-95 1000

Total Depth Drilled 20 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2' x 2" Sampling Interval Continuous feet

Land-Surface Elev. ~~612.83~~ 591.88 (KT 2/6/96) feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor GRAVES SERVICE CO. Driller Ron Helper Hal

Prepared By J. KIRKPATRICK Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
0	2	20"	12/16/9/11	CLAY, moderate reddish orange (10 R 6/6) w/ pale yellowish orange (10 YR 8/6) blebs, very stiff (cohesive), dry to damp, chert fragments (broken) throughout spoon, no odor (CL)	0.0
2	4	22"	12/18/36/40	CLAY w/ broken chert, clay is moderate reddish orange (10 R 6/6) yellowish orange (10 YR 6/6) blebs, very stiff, chert fragments throughout spoon and bottom 3" is all broken chert (crumbled), spoon is dry to damp, no odor (CL)	0.0
4	6	24"	18/7/9/10	CLAY, color as above, more clay less chert but still has chert throughout, damp to dry, very stiff, no odor. (CL)	0.0
6	8	22"	11/10/11/11	CLAY, mod. reddish orange (10 R 6/6) w/ yellowish blebs + black (N1) streaks, chert rubble throughout, very stiff, damp to dry, no odor (CL)	0.0
8	10	24"	7/10/11/11	CLAY, mod. reddish orange (10 R 6/6) w/ 4" lense of mottled orange and light greenish gray (5 GY 8/1), orange clay has chert frag., grayish lense is clean clay, layered (like shale), entire	0.0

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG (Cont.d)

Boring/Well ~~P-27~~ MW-24 JH 12/19/97

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
				spoon is very stiff, damp, no odor. (CL)	
10	12	24"	~~4/6/6/15~~ missed	CLAY, mod. reddish orange (10 R 6/6), w/ Chert fragments, very stiff, damp, no odor (CL)	0.0
12	14	24"	4/5/6/15	CLAY, mod. reddish orange (10 R 6/6) w/ light greenish gray (5 GY 8/1) lenses, bedded (weathered) very stiff, ~~some~~ trace chert fragments, soft wet zone (2") in middle, damp, no odor (CL)	0.0
14	16	20"	10/23/25/33	CLAY, mod. reddish orange (10 R 6/6), hard, looks like weathered (highly) rock, bedded (vertical) dry to damp, no odor (CL)?	0.0
			Refusal		
16	18	8"	25/36/50/5	CLAY, mod. reddish orange (10 R 6/6) w/ dark gray (N3) lenses (thin), appears bedded (vertical) (like a weathered rock), hard, dry, no odor	0.0
			Refusal		
18	20	4"	50/4"	CLAY, as above, appears to be weathered rock (shale)	0.0
			SPOON	REFUSAL - 18.0	
			NO AUGER	REFUSAL -	

Jason Kirkpatrick
2-18-95

G&M Form 04 6-86

JH 12/19/97

Southprint 87-1719

GERAGHTY & MILLER, INC.
Environmental Services

MW-2d JH 12/13/97

SAMPLE/CORE LOG

Boring/Well ~~P-29~~ Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 7-25-95 1320 Drilling Completed 7-25-95 1630

Total Depth Drilled 76.0 feet Hole Diameter 6" inches Type of Sample/Coring Device None

Length and Diameter of Coring Device ~~591.81~~ NONE (KT) 2/6/96 Sampling Interval None feet

Land-Surface Elev. ~~612.88~~ feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR ROTARY/HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller Dwight Pruitt Helper J. BUTLER

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	20	HSA		SEE O.B. LITHOLOGY LOG FOR P-29. (CLAY)
20	21	AIR ROTARY [illegible] core bit		CLAY, reddish brown, dry (10 R 3/4)
21	29			CLAY OR SHALE, highly weathered (like clay) medium dark gray (N4), dry, ~~hard~~ soft — larger chunks are thinly bedded like a shale but ~~fairly~~ not very hard.
29.0	54.5			SHALE, weathered to highly weathered, olive black (5 Y 2/1), dry, cuts smoothly w/ roller bit, larger cuttings are hard (but not like a rock)
54.5	66.75			SHALE, weathered, olive black (5 Y 2/1), dry, harder than shale above, bit is bouncing.
* 66.75	69.0	AIR HAMMER FROM 68'		SHALE, olive black (5 Y 2/1), hard, slow drilling
69	76			SANDSTONE, medium gray (N5) w/ some black flecks, very hard, crystaline, medium grained, Cuttings are damp - water suspected to be just above the hard rock (SHALE) at ~67 Ft.

Jason Kirkpatrick
7-25-95

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~P-28 D~~ MW-25S (JK) 7-25-95 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 7-13-95 0810 Drilling Completed 7-13-95 1045

Total Depth Drilled 20.0 feet Hole Diameter 7 1/4" inches Type of Sample/Coring Device Split Spoon (Steel)

Length and Diameter of Coring Device 2' x 2" Sampling Interval Every 5 feet

Land-Surface Elev. 558.70 (JK) 7/6/96 feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor GRAVES SERVICE CO. Driller Ron Helper Hal

Prepared By J. KIRKPATRICK Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	OVM
				SEE LITHOLOGY LOG FOR P-28D FOR DETAILED	
				LITHOLOGIC DESCRIPTIONS	
3	5	18"	8/6/6/5	SILT + SAND, dark reddish brown (10 R 3/4), none	0.0
				cohesive, loose, dry, overlying CLAY	
				CLAY is dark yellowish orange (10 YR 6/6),	
				medium stiff, damp to dry, no odor	
				(CL)	
8	10	14"	2/1/1/2	SILT(Y) fill material, bluish white (5 B 9/1)	0.0
				soft, damp to wet, sewer odor,	
13	15	14"	4/1/1/2	SILT(Y) fill material, bluish white (5 B 9/1)	0.0
				very soft w/ air bubbles, wet, sewer odor,	
18	20	16"	3/5/9/13	Mostly SILT(Y) Fill material as above (probably	
				from inside the augers) Tip of spoon has	
				some yellowish brown clay (10 YR 5/4)	
				SHELBY TUBE — 23.0 to 24.5 (Refusal at 24.5 ft)	

JWK 7-13-95

JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well MW-25S Project/No. TF0320.0.3 Page 1 of 1

Site Location SWSS-BIRMINGHAM, ALABAMA Drilling Started 7/14/95 Drilling Completed 7/18/95

Total Depth Drilled 46 feet Hole Diameter 6 inches Type of Sample/Coring Device —

Length and Diameter of Coring Device — Sampling Interval — feet

Land-Surface Elev. 558.76 feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used 50 GAL OF H_2O Drilling Method AIR ROTARY/HAMMER

Drilling Contractor GRAVES Driller JOHN M. Helper JB/DWIGHT

Prepared By J. HUGHES Hammer Weight — Hammer Drop — inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	28	HSA		SEE HSA LOGS FOR LITHOLOGY/DESCRIPTION
28	32	AIR ROTARY/		ROCK, (CHERT, S.S, & L.S), W/ (SOFT SPOTS & BROKEN SPOTS)
		10" HOLE		(HARD SPOTS ARE LESS THAN 1 FOOT THICK)
				SURFACE CASING SET TO 32FT BLS
32	46	AIR ROTARY		LIMESTONE, MED GRAY (N5), W/ ABUNDANT COARSE
		6" HOLE		CALCITE CRYSTALS FILLING FRACTURES/VEINS - FRACTURED
				45.75 HARD, UNFRACTURED L.S.
				FROM AIR ROTARY/BIT
22.5	24			BROKEN ROCK, L.S. W/CALCITE VEINS
24	25			L.S. HARD W/ CALCITE VEINS
25	26.5			L.S., BROKEN W/CALCITE VEINS
26.5	27			CLAY + L.S W/MINOR SAND & CHERT
27	31			BROKEN L.S. W/CALCITE VEINS POTENTIAL H_2O BEARING
31	34.75			L.S, BROKEN, W/SOFT SPOTS ZONE.
34.75	35.25			L.S., HARD, W/CALCITE VEINS
35.25	37			SOFT BROKEN L.S.
37	44			ALTERNATING HARD & SOFT L.S.
				JH 12/19/97

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SJD 12/19/97
7-25-95

SAMPLE/CORE LOG

Boring/Well MW-250 ~~P-28S~~ D (KP) Project/No. TF0520013 SLOSS INDUSTRIES Page 1 of 2

Site Location BIRMINGHAM ALABAMA Drilling Started 7-12-95 1130 Drilling Completed 7-12-95 1715

Total Depth Drilled 28.0 feet Hole Diameter 7¼ inches Type of Sample/Coring Device Split Spoon.

Length and Diameter of Coring Device 2' x 2" Sampling Interval Continuous feet

Land-Surface Elev. 556.87 feet (KT 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor GRAVES SERVICE CO. Driller RON Helper HAL

Prepared By J. KIRKPATRICK Hammer Weight 140 Hammer Drop 30 inches

	Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
FILL MATERIAL	0	2	18"	10/9/23/15	SILT + SAND, dark yellowish brown, (10YR 4/2)	0.0
					non-cohesive, loose, dry, no odor	
					~~(SM)~~ kt 2/6/96	
	2	4	18"	10/8/11/8	SILT + SAND, dark yellowish brown (10YR 4/2)	0.0
					non-cohesive, loose, dry, no odor.	
					~~(SM)~~ kt 2/6/96	
	4	6	16"	6/5/4/4	SILT and SAND, as above ~~(SM)~~ kt 2/6/96	0.0
	6	8	12"	1/2/1/1	SILT, trace sand, bluish white (5 B 9/1),	0.0
		not actually			semi-cohesive, soft, damp to wet, no odor	
		silt but the			(Appears similiar to the piles of white Sloss	
		closest geologic term that fits.			debris around the drilling area)	
	8	10	20"	2/2/2/2	SILT, trace sand, bluish white, (5 B 9/1)	0.0
					as above	
	10	12	24"	1/2/2/1	SILT(Y) fill material w/ trace sand (?) as	0.0
					above.	
	12	14	24"	5/5/1/2	SILT (Y) fill material, as above, wet	0.0
	14	16	24"	2/3/5/3	SILT(Y) FILL Material, as above, more plastic	0.0
	16	18	24"	2/2/3/2	SILT (Y) FILL Material, soft, w/ air bubbles,	0.0
					plastic, bluish white (5 B 9/1), wet, no odor	
BAD SPOON	~~18~~	~~20~~	~~24"~~	~~2/1/2/3~~	~~SILT(Y) FILL Material, as above, wet, sewer odor~~	JWK 7-12-95

GERAGHTY & MILLER, INC.
Ground-Water Consultants

JH 12/18/97
MW-25D
(a) 7-25-95

SAMPLE/CORE LOG (Cont.d)

Boring/Well ~~P-28~~ Page 2 of 2

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
18	20	21"	5/9/10/14	CLAY, pale yellowish orange (10 YR 8/6) medium stiff, trace white limestone rubble, damp, sewer odor (CL)	0.0
20	22	18"	9/18/12/19 (CL)	CLAY, some coarse limestone rubble (white) clay is mottled greenish gray (5 G 6/1) and dark yellowish orange (10 YR 4/6), medium stiff, damp, sewer odor	0.0 0.0
22	24	14"	4/4/4/8	CLAY, some limestone rubble (weathered) (white), clay is mottled color as above, medium stiff, ~~damp~~ wet, sewer odor.	
24	26	24"	5/12/27/24 Refusal	CLAY, w/ limestone rubble (gravel size chunks) mostly olive gray (5 Y 4/1), stiff, damp, sewer odor.	0.0
26	28	12"	25/50/5"	CLAY w/ limestone rubble, (gravel size broken L.S. w/ calcite), clay is ~~[illegible]~~ olive gray (5 Y 4/1), appears layered like a shale (may be highly weathered shale), very stiff to hard, dry, no odor, (CL).	0.0
			SPOON	REFUSAL - 27 ft bls.	-
			AUGER	REFUSAL - 28 ft bls.	

JW
7-12-95

JW 12/19/97

G&M Form 04 6-86

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SAMPLE/CORE LOG

MW-25D SR 12/19/97

Boring/Well ~~P-28D~~ Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 2

Location BIRMINGHAM ALABAMA Drilling Started 7-24-95 0800 Drilling Completed 7-26-95 1320

Total Depth Drilled 67.0 feet Hole Diameter 6 inches Type of Sample/Coring Device None

Length and Diameter of Coring Device 2' x 2" 2/6/96 Sampling Interval None feet

Land-Surface Elev. 556.37 feet (EJ) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER/ROTARY

Drilling Contractor GRAVES SERVICE CO. Driller DWIGHT PRUITT Helper J.B

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	28	HSA		SEE O.B. LITHOLOGY LOG FOR P-28S.
22	44			SEE LITHOLOGY LOG FOR P-28S (ROCK LOG)
23.0	24.0	9 7/8" Roller Cone bit		LIMESTONE, broken, weathered, gray w/ calcite
24.0	25.0			LIMESTONE, hard, gray.
25.0	27.5			LIMESTONE, broken + weathered, Clayey zones, gray (N5), calcite veins noted.
27.5	29.0 ~~31.0~~			LIMESTONE, broken, gray w/ calcite veins.
29.0	31.0			LIMESTONE, hard, gray - hard drilling, competent rock.
		31' - BOTTOM OF 6" STEEL SURFACE CASING.		
31	37			LIMESTONE, broken, weathered, some calcite, medium light gray (N6), medium hard, dry.
37	39			CLAY, medium light gray (N6), damp.
39	44			LIMESTONE, broken, weathered, medium light gray (N6), hard to medium hard.
44	63			LIMESTONE and CLAY (OR WEATHERED SHALE) in lenses about 1 to 2 ft thick throughout this zone. LIMESTONE is broken and weathered, medium

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SAMPLE/CORE LOG (Cont.d)

Boring/Well ~~P-28D~~ MW-25D JK 12/19/97

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
				gray (N6) w/ some calcite. CLAY (weathered shale) is medium gray also, smoother drilling, damp to ~~damp~~ wet JK
63	64			LIMESTONE, hard, medium light gray (N6) competent.
64	67			LIMESTONE, broken, weathered w/ calcite throughout, medium light gray (N6), medium hard to hard, wet.
		67	TOTAL DEPTH	

Jason Kirkpatrick
1-26-95

JK 12/19/97

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SAMPLE/CORE LOG

Boring/Well ~~P-24~~ MW-26 JH 12/19/97 Project/No. SLOSS TK0320.013 Page 1 of 2

Site Location SLOSS - BIRMINGHAM Drilling Started 6/12/95 Drilling Completed 6/12/95

Total Depth Drilled 22.8 feet Hole Diameter 7 1/4 inches Type of Sample/ Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 547.41 feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used —— Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	TID
0	2	1	11/7/7/6	CLAY, MOTTLED DUSKY BROWN & LIGHT BROWN, STIFF, w/ Is gravel & organics, DRY, NO ODOR (CL)	ND
2	4	1	4/6/7/10	CLAY, MODERATE BROWN, w/ DARK YELLOWISH BROWN BLEBS, STIFF, DRY, NO ODOR (CL)	ND
4	6	1	5/4/5/8	Same as 2-4, DRY, NO ODOR	ND
6	8	1.25	4/7/8/10	CLAY, MOTTLED, DARK YELLOWISH ORANGE → VERY PALE ORANGE, STIFF, w/ MINOR BLACK BLEBS, DRY, NO ODOR (CL)	ND
8	10	1.5	5/7/8/10	CLAY, GRAYISH ORANGE, w/ BLACK MOTTLING, STIFF, DRY, NO ODOR (CL)	ND
10	12	1.5	7/11/13/12	SAME AS 8-10, MOIST, NO ODOR	ND
12	14	1.5	3/5/5/3	CLAY, GRAYISH ORANGE, w/ LIGHT BROWN MOTTLING, STIFF, SATURATED, NO ODOR w/ SOME CHERT GRAVEL (CH)	ND

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SAMPLE/CORE LOG

Boring/Well ~~P-27~~ MW-26 JH 12/19/97 Project/No. SLOSS TE-320.013 Page 2 of 2

Site Location SLOSS, BIRMINGHAM, ALABAMA Drilling Started 6/12/95 Drilling Completed 6/12/95

Total Depth Drilled 22.8 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 547.41 feet KD 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used ——— Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	TIP
14	16	1.5	8/7/14/43	CLAY SAME AS 12-14, SATURATED (6") OVERLYING CLAY, MODERATE YELLOWISH BROWN, COHESIVE, W/ LS FRAGMENTS, DRY, NO ODOR - WEATHERED SURFACE (CL)	ND
17	19	0.5	6/9/11/14	CLAY, DARK YELLOWISH ORANGE, STIFF, MOIST, NO ODOR (CH)	ND
19	21	1.0	22/45/50+	CLAY SAME AS 17-19, SATURATED (6") OVERLYING SAME CLAY W/ L.S. FRAGMENTS (FINE GRAINED CRYSTALLINE L.S W/ COARSE CRYSTALS FILLING FRACTURES) (CL)	ND
22	~~24~~ 22.8	0.75	3/15/50+	CLAY + LS. FRAGMENTS SAME 19-21	ND
				REFUSAL ON 2ND SPOON ON FIRST SET OF BLOW COUNTS	

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SAMPLE/CORE LOG

JW 12/19/97

Boring/Well ~~PW-22~~ P-27 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-13-95 0900 Drilling Completed 6-14-95

Total Depth Drilled 141 feet Hole Diameter 8¼" 0 to 24' 5¾" 24-141 inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device NA Sampling Interval Continuous from ~~cuttings~~ feet

Land-Surface Elev. 547.41 feet 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used Water Drilling Method Air Hammer

Drilling Contractor GRAVES SERVICES Co. Driller John Helper J.B / DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	22	—	—	SEE LITHOLOGY LOG FOR OVERBURDEN FOR P-27 BY JOE HUGHES.
22	30	Rock	chips	LIMESTONE, crystaline, medium light gray (N6) w/ calcite filled fractures (white N9) hard, dry.
30	40	Rock	chips	LIMESTONE, crystaline, medium light gray (N6) w/ calcite filled fractures, hard, dry.
49.7	55.5	Rock hammer	chips / action	LIMESTONE, light gray, softer, dry
55.5	74.5			LIMESTONE, medium light gray (N6), hard, calcite filled fractures, dry.
74.5	~~76.5~~ 83	Jdk 8-21-95		LIMESTONE, as above
~~76.5~~ 83	91			SHALE (?), grayish brown, soft ~~LIMESTONE,~~
91	100			LIMESTONE, hard, medium dark gray (N4) numerous soft spots (~ ½ foot or less)
100	105			SHALE, grey brown, softer, moist.
105	135			LIMESTONE, dark medium gray (N4), hard occasional soft spot.
135	136			SHALE, brownish gray, soft. (potential water zone)
136	141			LIMESTONE, dark medium gray (N4), hard.

most water produced here (¼ gpm

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SAMPLE/CORE LOG

Boring/Well ~~P-26~~ MW-27 JH 12/15/97 Project/No. TF0320.013 Page 1 of 2

Site Location SLOSS-BIRMINGHAM Drilling Started 6/13/95 Drilling Completed 6/13/95

Total Depth Drilled 24 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. ~~552.02~~ 552.15 JH 12/15/97 feet (KB 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used ____ Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	TIP
0	2	1.0	9/7/5/3	water in hole CLAY, DARK YELLOWISH ORANGE, STIFF, SATURATED, NO ODOR w/ DUSKY BROWN MOTTLING & LS FRAGMENTS (RR. FILL) (CH)	ND
2	4	1.0	9/8/5/3	CLAY SAME AS 0-2 w/ 0.35' OF LIGHT BROWN CLAY, STIFF, ~~MOIST~~ SATURATED AT BOTTOM OF SPOON (CH)	ND
4	6	1.5	5/10/10/11	CLAY, MODERATE TO DARK YELLOWISH ORANGE, STIFF, MOIST, NO ODOR w/ LT BROWN & BLACK MOTTLING (CH)	
6	8	1.25	9/12/13/19	CLAY SAME AS 4-6 w/ MINOR AMTS OF IRON CONCRETIONS, GRAVEL SIZE, DRY, NO ODOR (CL)	ND
8	10	1.5	11/10/14/14	CLAY, MOTTLED GRAYISH ORANGE TO VERY PALE ORANGE, STIFF, DRY, NO ODOR MINOR LIGHT BROWN MOTTLING (CL)	ND
10	12	1.5	12/14/18/23	CLAY, MOTTLED DARK YELLOWISH ORANGE & GRAYISH ORANGE, STIFF, DRY, NO ODOR, SOME BLACK SPECKS IN CLAY (SMALL IRON CONCRETIONS POSSIBLY) FN GR SND SIZE (CL)	ND
12	14	1.5	4/6/11/18	CLAY SAME AS 10-12 (CL)	

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SAMPLE/CORE LOG

Boring/Well ~~P-26~~ MW-27 JH 12/15/97 Project/No. TF0320.013 Page 2 of 2

Site Location SCOSS BIRMINGHAM Drilling Started 6/13/95 Drilling Completed 6/18/95

Total Depth Drilled 24 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. ~~552.02~~ 552.15 JH 12/15/97 feet (KT 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used ______ Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DENALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	TIP
14	16	1.0	5/4/15/16	CLAY, DARK YELLOWISH ORANGE, STIFF, MOIST, H_2S ODOR, W/ LS FRAGMENTS, FN GR CRYSTALLINE LS. (CL)	ND
16	18	1.75	19/18/18/19	CLAY, MOTTLED, DARK YELLOWISH ORANGE TO GRAYISH ORANGE, STIFF, ~~DRY~~, NO ODOR, W/ SOME BLACK FN GR TO MED GR SAND SIZED PARTICLES (IRON CONCRETIONS) (CL)	ND
18	20	1.5	4/3/4/6	CLAY SAME AS 16-18 W/ SOME LENSES OF CLAY LIGHT BLUISH GRAY, MOIST, NO ODOR (CH)	
20	22	1.75	1/1/2/3	SAME AS 18-20, MOIST, NO ODOR (CH)	ND
22	24	1.75	3/15/37/15/	CLAY SAME AS 20-22, SATURATED, NO ODOR, OVERLYING 0.75' OF FN GR CRYSTALLINE LS., BROKEN UP (CH)	ND
24	26		50	REFUSAL HAVE FOUND TOP OF ROCK SURFACE	
				TAKING SHELBY TUBE FROM 20 TO 23 FT BLS	

G&M Form 02.6.86

000147 JH 12/15/97

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Environmental Services

SAMPLE/CORE LOG

MW-27 JH 12/15/97

Boring/Well ~~P-26~~ Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-13-95 1530 Drilling Completed 6-13-95 (KP)

Total Depth Drilled 37 (JB) feet Hole Diameter 9 3/4" to 25' 6" to 37 inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. ~~552.07~~ 552.15 JH 12/15/97 feet (KP) 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used none or water Drilling Method AIR HAMMER

Drilling Contractor GRAVES ENVIRONMENTAL Driller John Helper Dwight / J.B.

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	23			SEE LITHOLOGY FOR 0-23 BY JOE HUGHES
23	23.8	Rock cuttings		LIMESTONE, fractured, soft, grey color.
23.8	28.75			LIMESTONE, medium gray, hard, crystaline.
				dry, many calcite filled fractures throughout.
28.75	29.00			LIMESTONE, dark yellowish brown (10 YR 4/2),
				weathered, softer, water bearing.
29.0	37.0			LIMESTONE, medium light gray (N6), hard,
				fractured w/ calcite filling.

Jason [illegible] 8-29-97 [illegible]

G&M Form 03 6-86

~~000148~~ (JH) [illegible]

Southprint 89-1257

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Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~TC-25~~ MW-2B JH 12/19/97 Project/No. TF0320.03 Page 1 of 2

Site Location SLOSS - BIRMINGHAM Drilling Started 6/13/95 Drilling Completed 6/13/95

Total Depth Drilled 18.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 556.44 feet (KT) 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	TIP
0	2	1.5	10/7/5/7	CLAY, LIGHT BROWN, STIFF, DRY, NO ODOR W/ SOME ORGANICS (ROOTS) W/ 0.75' OF COAL (COKE) ON TOP OF SPOON (CL)	ND
2	4	1.5	3/5/8/13	CLAY SAME AS 0-2 W/ MINOR DARK YELLOWISH ORANGE MOTTLING, STIFF, DRY, NO ODOR (CL)	ND
4	6	1.5	9/14/14/17	CLAY SAME AS 2-4 W/ MINOR DARK YELLOWISH ORANGE & BLACK MOTTLING, STIFF, DRY, NO ODOR (CL)	ND
6	8	1.0	11/16/16/15	CLAY, LIGHT BROWN W/ MINOR DARK YELLOWISH ORANGE MOTTLING, STIFF, NO ODOR, MOIST S/S WAS MOIST ON OUTSIDE (CL)	ND
8	10	1.5	5/5/8/12	CLAY, OLIVE BLACK, STIFF, DRY, NO ODOR, OVERLYING CLAY, MOTTLED MODERATE BROWN TO DARK YELLOWISH ORANGE, STIFF, DRY, NO ODOR W/ SOME GRAVEL SIZED CONCRETIONS (CL)	ND
10	12	1.5	2/4/4/7	CLAY, MOTTLED MODERATE BROWN, DARK YELLOWISH ORANGE, & PALE BLUE, STIFF, DRY, NO ODOR (CL)	ND
12	14	1.9	11/11/12	CLAY SAME AS 10-12, STIFF, DRY, NO ODOR SUCTION FOUND PULLING S/S OUT OF HOLE (CL)	ND

~~000143~~ JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~B-25~~ MW-28 JH 12/19/97 Project/No. TF0320.013 Page 2 of 2

Site Location SLOSS - BIRMINGHAM Drilling Started 6/13/95 Drilling Completed 6/13/95

Total Depth Drilled 18.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 556.44 feet KT 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	T.P
14	16	1.75	3/5/5/5	CLAY SAME AS 12-14, STIFF, DRY→MOIST, NO ODOR	ND
16	18	1.75	8/14/10/11	CLAY SAME AS 12-14, STIFF, DRY→MOIST (BOTTOM OF S/S), NO ODOR (CL — CH)	
18	20		+50	.3" PENETRATION w/ 50 blows	

000144 JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~P-25~~ MW-28 JH 12/19/97 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-15-95 1100 Drilling Completed 6-15-95 1500

Total Depth Drilled 58.0 feet Hole Diameter 6 1/8" inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 556.44 feet KB 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR / Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller JOHN M. Helper J.B/DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	~18	———		SEE O.B. LOG FOR LITHOLOGY FOR P-25 (BY JOE HUGHES)
16.5	18.5	Rock chips + hammer action		Hard fractured LIMESTONE, light gray (N7)
18.5	19.0			CLAY, yellowish brown.
19.0	32.5			LIMESTONE, light gray (N7), hard, some fractures (?).
32.5	35.0			LIMESTONE, light gray (N7 to N6), medium hardness, (i.e. softer than above)
35.0	52.5			LIMESTONE, light gray (N7), hard w/ soft lenses (from 41' to 45'), some calcite (white N9) filled veins.
52.5	53.0			LIMESTONE, light medium gray (N6), soft, large calcite filled fractures (veins), water bearing zone.
53.0	58.0			LIMESTONE, light gray (N7), hard, small calcite filled veins, dry.
		58.0-TOTAL DEPTH		

Jack 6-15-95

~~000145~~ 54 12/19/97

G&M Form 03 6-86 Southprint 89-1257

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well MW-29 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/7/97 Drilling Completed 8/7/97

Total Depth Drilled 19 feet Hole Diameter 6 inches Type of Sample/Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 561.86 feet ☒ Surveyed ☐ Estimated Datum AMSL

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper ALTON/DWIGHT/JOHN

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

	Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	
	0	3	AUGERS		COKE	ND
	3	5	AUGERS		CLAY AS 5-7	ND
	5	7	2.0	3/4/9/15	CLAY, light brown (5YR5/6), stiff, no odor, moist (CL)	ND
	7	9	2.0	15/24/22/20	FILL (?) CLAY HAD RELATIVELY FRESH GRASS IN IT	ND
FILL					CLAY, light brown (5YR5/6), stiff, w/COKE, MOIST, NO ODOR (CL)	
	9	11	2.0	3/4/6/10	CLAY w/ COKE IN IT. (CL) DARKER	ND
					COLOR TOP FOOT OF SPOON DUE TO COKE, STIFF, NO ODOR, MOIST	
	11	13	1.5	9/11/13/13	CLAY, light brown (5YR5/6), stiff, no odor, dry to moist (CL)	ND
	13	15	1.75	5/6/11/13	CLAY, light brown (5YR5/6), very stiff, dry, no odor (CL)	ND
1200 *	15	17	2.0	11/12/14/15	CLAY, light brown (5YR5/6) w/ med gray (N5) mottling, stiff, moist,	ND
					no odor (CL)	
	17	19	2.0	19/19/20/22	CLAY, light brown (5YR5/6), stiff to plastic (at bottom)	ND
					dry to moist, no odor (CL-CH)	
1220 *	19	21	2.0	4/7/7/10	CLAY as above, moist, no odor w/ some med brown (5YR4/4)	ND
					mottling (CH-CL)	
	21	23	0.5	14/50/3	CLAY AS ABOVE (0.25') + ROCK (L.S.) IN BOTTOM OF SPOON	ND
					(CL-CH)	

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SAMPLE/CORE LOG

Boring/Well MW-29 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/12/97 Drilling Completed 8/12/97

Total Depth Drilled 26/36.5/38 feet Hole Diameter 8.75/6/4 inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device NA Sampling Interval NA feet

Land-Surface Elev. 561.86 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used POTABLE H2O + AIR Drilling Method AIR ROTARY/HAMMER

Drilling Contractor Graves Service Company, Inc. Driller JOHN M. Helper DWIGHT/ALTON/RON

Prepared By Joe Hughes Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	21.5			SEE HOLLOW STEM AUGER LOG
21.5	22	AIR ROTARY	CUTTINGS	LIMESTONE, MED GRAY (N7), BROKEN, HARD
22	24.25			LIMESTONE, MED GRAY (N7), HARD + CLAY
24.25	25.25			LIMESTONE, MED GRAY (N7), HARD
25.25	25.5			CLAY
25.5	26			LIMESTONE, MED GRAY (N7) HARD
				TEMPORARY SURFACE CASING SET AT 26 FT BLS
26	27	AIR HAMMER		LIMESTONE MED GRAY (N7) HARD
27	28			CAVITY
28	29			LIMESTONE, MED GRAY (N7), MEDIUM HARD
29	30.7			LIMESTONE, MED GRAY (N7), HARD w/ CALCITE
30.7	31			SOFT SPOT
31	36.5			LIMESTONE, MED GRAY (N7) w/ some GRAYISH ORANGE (10YR 7/4)
				DOLOMITIZED AREAS, HARD, w/ ABUNDANT CALCITE FILLED
		SOFT SPOT AT 33		VEINS (SOME QUITE LARGE), + STRUCTURAL FEATURES (SLICKENSIDES)
				+ DISSOLVED APPEARANCE (CALCITE FILLED VEINS STANDING OUT
				IN RELIEF FROM FINE GRAINED GROUND MATRIX - IMPLIES HIGHER
				POTENTIAL FLOW RATES)
36.5	38	4" TRICONE		LIMESTONE AS 31 TO 36.5
				ESTIMATED Q OF 6-12 GPM (DRILLERS ESTIMATE)

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Southprint 87-1718

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SAMPLE/CORE LOG

Boring/Well ~~P-255~~ P-255 (KP) MW-30S JH 12/19/97 Project/No. TF0320.013 Page 1 of 1

Site Location SLOSS BIRMINGHAM Drilling Started 6/14/95 Drilling Completed 6/14/95

Total Depth Drilled 17.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. ~~564.60~~ 562.21 (KB 2/6/96) feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	TIP
3	5	1.25	8/4/8/8	CLAY, MODERATE BROWN w/ DUSKY YELLOWISH BROWN BROWN, STIFF, MOIST, NO ODOR, w/ SOME ORGANICS (CL)	2.5
8	10	1.25	8/7/13/18	CLAY, MOTTLED DARK YELLOWISH ORANGE, GRAYISH ORANGE, & BLACK, STIFF, DRY, NO ODOR + SOME GRAVEL (L.S.? & ROCK). (CL)	3.3
15	17.5			SHELBY TUBE	

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SAMPLE/CORE LOG

Boring/Well ~~P-24S~~ MW-30S (JU 12/19/97) Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-20-95 1000 Drilling Completed 6-20-95 1230

Total Depth Drilled 35.0 feet Hole Diameter 8 3/4" 0-20.9 5 3/4"-20-35 inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. ~~564.69~~ 562.21 feet (KF 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller JOHN MITCHEL Helper J.B / DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	20			SEE O.B. LITHOLOGY LOG (G+M - JOE HUGHES)
				CLAY, yellow brown, reddish brown, some gravel.
20.3	20.9	Drill cuttings + hammer action		LIMESTONE, hard, gray.
				Set bottom of temp. surface casing at 20.9 ft
				(casing will be pulled during grouting.)
20.9	22.75			LIMESTONE, hard, gray (N7)
22.75	24.5			LIMESTONE, soft, light olive gray (5Y 5/2)
				(shale?)
24.5	26.0			LIMESTONE, hard, gray (N7)
26.0	27.5			LIMESTONE, medium hard, gray (N7)
27.5	29.0			LIMESTONE, hard, gray (N7)
* 29.0	29.5			LIMESTONE, soft spot, gray to brownish gray
				(5YR 4/1). Water zone
29.5	33.5			LIMESTONE, hard, w/ soft spots, gray.
33.5	35.0			LIMESTONE, medium hard, fractured/broken,
				(chunks of rock comming up - not cut by hammer)
				Olive gray (5Y 4/1) dolomite streaks in gray.
				Limestone.
		35.0	TOTAL DEPTH	

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SAMPLE/CORE LOG

Boring/Well ~~P20D~~ MW-30D JH 12/19/97 Project/No. TF0320.013 Page 1 of 2

Site Location SLOSS BIRMINGHAM Drilling Started 6/14/95 Drilling Completed 6/14/95

Total Depth Drilled 19.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 562.26 (KT 2/6/96) feet ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used —— Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	T.P
0	2	1.0	5/12/7/12	~~COKE~~ & CLAY MIXTURE FOR ROAD	NO
				CLAY LT BROWN & DARK YELLOWISH BROWN MOTTLED,	
				STIFF, SATURATED, NO ODOR (CL)	NO
2	4	1.25	5/10/11/13	CLAY, DUSKY YELLOWISH BROWN → MODERATE BROWN	
				(BOTTOM OF SPOON (3")), STIFF, DRY, NO ODOR +	
				SOME ORGANICS. (CL).	
4	6	1.0	5/12/10/12	CLAY, LIGHT BROWN, STIFF, DRY, NO ODOR +	NO
				ORGANICS (CL)	
6	8	1.0	6/9/9/14	CLAY SAME AS 4-6, STIFF DRY, NO ODOR	NO
				+ SOME SAND, MED GR, & GRAVEL (CL)	
8	10	1.0	5/5/8/15	CLAY SAME AS 6-8, STIFF, DRY, NO ODOR	NO
				+ SOME GRAVEL (HEAVY MINERAL, CRUSHED QTZ, & COAL/COKE)	
				(CL)	
6	12	0.75	2/5/8/16	CLAY SAME AS 8-10, DARK YELLOWISH ORANGE, STIFF, DRY, NO ODOR	1.5
				+ SOME GRAVEL (COKE) + ROCK GRAVEL (CL)	
12	14		16/29/34/44	CLAY, DARK YELLOWISH ORANGE W/ VERY PALE	6.7
1.				ORANGE MOTTLING, STIFF, DRY, NO ODOR	
				+ ORGANICS (ROOTS) (CL)	

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JH 12/19/97

SAMPLE/CORE LOG

Boring/Well ~~P-24D~~ MW-30D Project/No. TF0B20.013 Page 2 of 2

Site Location SCOSS - BIRMINGHAM Drilling Started 6/14/95 Drilling Completed 6/14/95

Total Depth Drilled 19.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 562.26 feet KT 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONALD

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	TID
14	16	2.0	4/7/12/12	CLAY, DARK YELLOWISH ORANGE W/ BLACK & LIGHT BROWN MOTTLING, STIFF, DRY, NO ODOR (CL)	10.5
16	18	1.0	6/9/13/16	CLAY SAME AS 14-16, STIFF, DRY, NO ODOR, W/ SOME ORGANICS (ROOTS) (CL)	7.1
18	20	1.25	3/5/9/50+	CLAY, MOTTLED DARK YELLOWISH ORANGE PALE YELLOWISH ORANGE, STIFF, DRY, NO ODOR OVERLYING 3" OF FINE CRYSTALINE LS. IN BOTTOM OF SPOON	5.6
				50 BLOWS FOR 1" ON SECOND SPOON. FINE GRAINED CRYSTALINE LS W/ COARSE CALCITE CMT FILLING FRACTURES IN BOTTOM OF SPOON.	

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SAMPLE/CORE LOG

MW-30D JW 12/19/97

Boring/Well ~~P-24D~~ Project/No. SLOSS INDUSTRIES TF0320013 Page 1 of 2

Site Location BIRMINGHAM ALABAMA Drilling Started 6-15-95 1700 Drilling Completed 6-16-95 0815

Total Depth Drilled 59.0 feet Hole Diameter 8 3/4" 0 to 16' inches Type of Sample/ Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 562.26 feet KT 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller JOHN MITCHELL Helper J.R / DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	16			SEE LITHOLOGY LOG FOR O.B. PREPARED BY
				J. HUGHES (G+M)
16.0	17.0	AIR HAMMER DRILLING		CLAY, yellowish red brown, (appears mottled)
				soft.
17.0	19.5			LIMESTONE, broken up, gray color, weathered,
				med. hard.
19.5	21.7			LIMESTONE, hard, light gray color (N6)
21.7	22.7			LIMESTONE, hard, fractured, light gray.
* 22.7	26.0			LIMESTONE, gray (N6 or N7), soft w/
				lots of fractures, water bearing zone (muddy)
~~Z~~				producing 1 to 2 gpm.
26.0	27.0			LIMESTONE, gray (light) N6, hard.
* 28.5	29.3			LIMESTONE, olive gray (5Y 4/1) w/ many
				calcite veins (white N9), softer limestone
				water zone (2-3 gpm)
29.3	37.0			LIMESTONE, hard to medium hard, some
				calcite veins, ~~dark~~ medium gray (N5) to Olive gray
				(5Y 4/1)
37.0	39.0			LIMESTONE, light gray (N7), hard.
* 39	46.0			LIMESTONE, soft to medium hardness, olive

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SAMPLE/CORE LOG (Cont.d)

Boring/Well MW-30D ~~P-24D~~ JH 12/19/97

Page 2 of 2

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
		AIR	HAMMER	gray (5Y 4/1), calcite filled veins throughout
				(potential water zone)
46.0	47.0			LIMESTONE, soft, gray
47.0	53.5			LIMESTONE, medium light gray (N6), hard
* 53.5	55.7			LIMESTONE, soft w/ calcite veins, olive
				gray (5Y 4/1), water bearing zone, good
				producer
55.7	57.3			LIMESTONE, Hard, medium light gray and
				olive gray.
* 57.3	59.0			LIMESTONE, soft to medium hard,
				olive gray (5Y 4/1) and gray (N5), possible
				water zone.
		59.0		TOTAL DEPTH

[signature]
6-16-95

G&M Form 04 6-86

JH 12/19/97

~~000142~~

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SAMPLE/CORE LOG

Boring/Well MW-31 Project/No. Sloss Industries / TF0320.015 Page 1 of 7

Site Location Birmingham, AL Drilling Started 8/6/97 Drilling Completed 8/6/97

Total Depth Drilled 14 feet Hole Diameter 6 inches Type of Sample/ Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 569.96 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper ALTON/JOHN/DWIGHT

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	2	2.0	4/8/10/15	FLUE DUST, dry, no odor
2	4	2.0	4/5/4/5	FLUE DUST, wet, no odor
4	6	2.0	4/8/16/50/6	FLUE DUST, wet, no odor
6	8	2.0	4/12/23/32	FLUE DUST, wet, no odor w/ 0.1' OF
				CLAY IN BOTTOM OF SPOON, MOD BROWN (5YR 4/4),
				very stiff, dry
8	10	1.25	14/13/15/8	FLUE DUST, WOOD, ROCK (L.S.), & COAL; CLAY w/ COKE (FILL)
				FILL MATERIAL
10	12	0.25	4/8/15/17	CLAY, MOD BROWN (5YR 4/4) w/ SOME LIGHT BROWN
		FILL ALSO		MOTTLING (5YR 5/6), stiff, w/ L.S. (fine
				grained recrystallized) fragments (float?)
12	14	0.5	4/3/16/15	FILL; CLAY AS ABOVE w/ COKE FRAGMENTS
				& FRAGMENTS (GRAVEL SIZE) OF L.S. PLASTIC, MOIST
14	16	0.1		ROCK (L.S), WOOD, etc
				POSSIBLY THIS IS FILL MATERIAL
16	18	0.1		ROCK (L.S)
				AUGER NOT ABLE TO GO DEEPER THAN 14 FT BLS
				NO SAMPLES COLLECTED FOR ANALYSIS

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SAMPLE/CORE LOG

Boring/Well MW-31 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/12/97 Drilling Completed 8/13/97

Total Depth Drilled 19 / 47 feet Hole Diameter 10" / 6" inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device NA Sampling Interval NA feet

Land-Surface Elev. 569.46 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used Potable H_2O + Air Drilling Method Air Rotary / Hammer

Drilling Contractor Graves Service Company, Inc. Driller John Mitchell Helper Dwight / Alton [illegible]

Prepared By Joe Hughes Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	14			SEE HOLLOW STEM AUGER LOGS
13	15	AIR ROTARY	CUTTINGS	FILL, METAL, ROCK, ETC
15	17			LIMESTONE, FRACTURED & BROKEN
17	19			LIMESTONE, HARD
				CASING SET TO 19 FT BLS
21	22	AIR HAMMER	CUTTINGS	LIMESTONE, BROKEN, + CLAY (LIGHT OLIVE GRAY 5Y5/2)
				VERY STIFF, MOIST
22	25.5			CLAY, LIGHT OLIVE GRAY (5Y 5/2), VERY STIFF, MOIST
25.5	26			LIMESTONE, MED GRAY (N7), FRACTURED
26	28.5			LIMESTONE, VERY HARD, VERY LITTLE CALCITE, MED GRAY (N7)
28.5	29			LIMESTONE, MED GRAY (N7), MED HARD, FRACTURED, W/SOME
				MOD YELLOWISH BROWN (10YR 5/4) LIMESTONE (POSSIBLY WEATHERED)
29	~~33~~ 35			LIMESTONE, MED GRAY (N7), HARD
				SOFT SPOT (W/SHALE OR WEATHERED LIMESTONE) AT 33 TO 33.25
35	38			LIMESTONE, SOFT
38	41			LIMESTONE AS 29 TO 35
41	44.25			LIMESTONE, MED GRAY (N7) MED SOFT
44.25	47			LIMESTONE AS 29 TO 35
				TD 47

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SAMPLE/CORE LOG

Boring/Well P-7 (KT) Jul 12 1997 MW-32 Project/No. TF0320.013 Page 1 of 1

Site Location Swoss - Birmingham Drilling Started 6/17/95 Drilling Completed 6/17/95 (19)

Total Depth Drilled 12 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device s/s

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 567.24 feet ☒ Surveyed (KT) 2/6/96 ☐ Estimated Datum MSL

Drilling Fluid Used ___ Drilling Method HSA

Drilling Contractor Graves Driller Ron Helper Donny / Hac

Prepared By J. Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	T.P
0	2	.5	10/14/4/11	SILTY SAND, BROWNISH BLACK, LOOSE, DRY, NO ODOR, (FINE DUST) ~~(SM)~~ KT 2/6/96	8.1
2	4	1.5	9/6/6/6	SILTY SAND AS ABOVE ~~(SM)~~ KT 2/6/96	9.3
4	6	1.25	5/3/5/2	SILTY SAND AS ABOVE ~~(SM)~~ KT 2/6/96	5.9
6	8	1.25	3/3/1/3	SILTY SAND AS ABOVE ~~(SM)~~ KT 2/6/96	7.3
8	10	1.25	3/25/50	1/2" PENETRATION W/ 50 BLOWS AT 9.0 SILTY SAND AS ABOVE, (SM) SATURATED; W/ LS (FN GR XLS) IN BOTTOM OF S/S	6.4
10	12	0.5	17/10/11/17	LS FRAGMENTS (FN GR XLS) BROKEN (FRACTURED OR WEATHERED) LS. AUGERS WILL NOT GO DEEPER THAN 5 9FT BLS BECAUSE OF AUGER WALL.	

~~000091~~ (Jul 12 1997)

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JH 12/19/97

SAMPLE/CORE LOG

Boring/Well P-7 MW-32 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 4

Site Location BIRMINGHAM ALABAMA Drilling Started 6-19-95 1340 Drilling Completed 6-21-95 1230

Total Depth Drilled 47.5 feet Hole Diameter 9 7/8" 0 to 23.0; 6 1/8" 23-47 inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 567.24 feet ☒ Surveyed ☐ Estimated (KT 2/6/96) Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller John Mitchell Helper DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	9	~	~	SEE LITHOLOGY LOG FOR 0.8 FOR P-7 (JOE HUGHES) - CLAY + FILL MATERIAL (RUBBLE, SAND + SILT)
8.5	11.5	Roller cone bit for surface casing (cuttings)		LIMESTONE, gray (N7), hard to medium hard, fine grained, competent. No water.
11.5	18.5			SILTY SAND, dark brownish black, loose, moist to saturated, strong creosote odor. Hit water at ~16 ft bls.
18.5	19.5			LIMESTONE, gray (N7), hard to medium hard.
19.5	22.0			CLAY or SILTY SAND, hard to tell, dark brown, saturated.
22.0	42.5			LIMESTONE, gray (N7) & hard. Seem competent SET SURFACE CASING - BOTTOM AT 23.0 ft bls.
42.5	43.0			LIMESTONE, w/ calcite veins, dark gray (N3) hard but some fractures, water bearing zone (producing 1/2 to 1 gpm - estimated)
43.0	47.5			LIMESTONE, gray (N7) to dark gray (N3) hard.

JWK 6-21-95

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SAMPLE/CORE LOG

Boring/Well MW-33 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/ 8/97 Drilling Completed 8/ 8/97

Total Depth Drilled 13 feet Hole Diameter 6 inches Type of Sample/ Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' X 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 554.96 feet ☒ Surveyed ☐ Estimated Datum ~~554.96~~ JH ft a-s l

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper HAL /CHUCK

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
0	2	2.0	4/16/9/9	FLUE DUST + SOME RUBBER	ND
2	4	1.5	6/5/6/12	FLUE DUST, MOIST, NO ODOR	ND
4	6	2.0	10/4/4/5	FLUE DUST, SATURATED, NO ODOR	ND
6	8	2.0	9/8/8/7	FLUE DUST, SATURATED, NO ODOR	ND
8	10	1.0	4/7/11/10	~~FLUE +~~ CLAY, PALE OLIVE 10Y6/2 W/ LIGHT BROWN 5YR5/6 MOTTLING	NE
				STIFF, W/ ROUNDED PEBBLES, DRY, NO ODOR (CL)	
10	12	2.0	4/6/8/9	~~CLAY/ST~~ FLUE DUST + SOME CLAY AS 8-10 MIXED IN	
				UNSURE IF THIS IS A BAD SPOON OR CLAY ABOVE IS	
				FILL.	
12	14	0.5	4/8/50/5	CLAY AS 8-10 W/ ROCK (CL)	
				FLUE DUST IN TOP OF SPOON	
				FLUE DUST MUST BE FLOWING IN SPOON HOLE	
				CLAY MAY BE FROM 19 TO 13	
				WILL COLLECT ANOTHER SAMPLE FROM 11 TO 13	
11	13				

1625

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well MW-33 Project/No. Sloss Industries / TF0320.015 Page 1 of

Site Location Birmingham, AL

Drilling Started 8/ 9 /97 Drilling Completed 8/ 11 /97

Total Depth Drilled 26.5/39 feet Hole Diameter 10" inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device — Sampling Interval — feet

Land-Surface Elev. 554.46 feet ☒ Surveyed ☐ Estimated Datum 554.46 FT AMSL

Drilling Fluid Used POTABLE H2O Drilling Method AIR ROTARY/HAMMER

Drilling Contractor Graves Service Company, Inc. Driller JOHN M Helper RON ALTON

Prepared By Joe Hughes Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	14			SEE OVERBURDEN LOG.
14	20	AIR ROTARY	3 FEET	LIMESTONE, HARD, FRACTURED, MED GRAY (N5)
				W/ LIGHT BROWN (5YR 5/6), DOLOMITIZED IN
				LIGHT BROWN AREAS
20	23			LIMESTONE, MEDIUM TO SOFT, MED GRAY (N5)
				NO DOLOMITIZED INTERVALS
23	26.5			LIMESTONE, HARD, LIKE 14-20 EXCEPT NOT
				FRACTURED.
				STEEL CASING SET TO 26.5 FT BLS
26.5	29.5			LIMESTONE, MED GRAY (N7), HARD TO MED HARD,
				DRY
29.5	30			SOFT SPOT, H_2O BEARING (1-5 GPM)
33				SOFT SPOT, TRACE TO SOME CALCITE FILLED
				VEINS
34.5	38			LIMESTONE, MED GRAY (N7), SHALEY, SOFT
38	39			LIMESTONE, MED GRAY (N7), HARD.

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SAMPLE/CORE LOG

Boring/Well ~~P-6D~~S MW-34S JK 12/19/97 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-19-95 1045 Drilling Completed 6-26-95 0900

Total Depth Drilled 34.5 feet Hole Diameter 9 7/8" 0-16 ~~6 1/2 16-34.5~~ inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 543.84 feet ☒ Surveyed KT 2/6/96 ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller John Mitchell Helper Dwight

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

KT 2/6/96

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	12		—	SEE O.B. LITHOLOGY LOG FOR P-6D (JOE HUGHES) – CLAY + FILL MATERIAL (GRAVEL + RUBBLE).
11.25	13.5	cuttings		LIMESTONE + CLAY, broken weathered L/S intermixed w/ O.B. clay.
13.5	14.0			LIMESTONE, hard, gray
14.0	14.5			LIMESTONE, soft gray
14.5	16.0			LIMESTONE, hard, gray, fine grained Set Surface casing bottom at 16.0 ft bls.
16.0	29.5 ~~34.5~~			LIMESTONE, gray (N7), fine grained, hard, competent, dry.
* 29.5	30.25			LIMESTONE, gray (N7) to dark gray (N4) medium hard to soft, broken up rock w/ calcite veins (large calcite chunks 1/4") Water bearing zone - ~ 3+ gpm)
30.25	34.5			LIMESTONE, hard, gray (N7) (dry?)
		34.5		TOTAL DEPTH

J Kirkpatrick

000060 — JK 12/19/97

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Environmental Services

SAMPLE/CORE LOG

Boring/Well MW-34D JH 12/19/97 ~~R-6D~~ Project/No. TF0320.013 Page 1 of 1

Site Location SLOSS-BIRMINGHAM, AL Drilling Started 6/16/95 Drilling Completed 6/16/95

Total Depth Drilled 11.5 feet Hole Diameter 7 1/4 inches Type of Sample/ Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 544.00 feet (KT 2/6/96) ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DONNY / HAL

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

KT 2/7/96

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	TIP
0	2	1.0	4/11/5/5	FILL (0.5') ~~(GW)~~ OVERLYING ~~CLAY~~, → SILTY SAND, BROWNISH BLACK, MOIST, NO ODOR (SM)	ND
2	4	1.5	9/5/10/14	~~CLAY~~ → SILTY SAND, BROWNISH BLACK SATURATED NO ODOR + LS FRAGMENTS (FILL), ORGANIC SILT (SM)	ND
4	6	1.75	17/35/24/13	SAME AS ABOVE (FILL MATERIAL vf gr silty SAND, w/ORGANIC SILT (SM)	ND
6	8	2.0	11/11/9/8	FILL AS 4-6 (SM) OVERLYING 1FT OF CLAY MODERATE YELLOWISH ORANGE, PLASTIC, SATURATED, NO ODOR ((H)	
8	10	1.0	14/1/1/1	FILL, GRAVEL & BLACK SILTY SAND, DRY, NO ODOR (SM)	
10	12	1.75	6/9/11/50+	4" PENETRATION w/50 BLOWS CLAY, DARK YELLOWISH BROWN W/LIGHT BROWN MOTTLING, STIFF, MOIST, NO ODOR W/ LS FRAGMENTS IN BOTTOM OF SPOON (FNGR XLS) (CL-CH)	

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SAMPLE/CORE LOG

Boring/Well ~~P-6D~~ MW-34D JL 12/19/97 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 2

Site Location BIRMINGHAM ALABAMA Drilling Started 6-19-95 0835 Drilling Completed 6-21-95 1000

Total Depth Drilled 181 feet Hole Diameter 9 7/8" 0 to 16 ~~5 3/4" 16-181~~ inches Type of Sample/Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 544.00 feet ☒ Surveyed (KT 2/6/96) ☐ Estimated Datum MSL ~~AIR HAMMER~~ JWK 6-21-95

Drilling Fluid Used AIR/WATER Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller John Mitchell Helper Dwight

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	12	~	~	SEE LITHOLOGY LOG FOR P-6S O.B. (JOE
				HUGHES) – CLAY + FILL MATERIAL (RUBBLE)
12	16	Roller mud	cone bit cuttings	LIMESTONE, highly fractured and broken,
				medium hard to soft, gray (N7). Became
				hard + competent from 15.0' to 16.0"
				SURFACE CASING SET – BOTTOM AT 16.0' bls.
16	19			LIMESTONE, gray (N7), hard, fine grained.
19	35			LIMESTONE, gray (N7) medium hard
35	38			LIMESTONE, gray, hard, dry
38	39			LIMESTONE/SHALE zone, soft, gray (N7) +
				dark gray (N3) dry
39	51.5			LIMESTONE, hard, gray (N7). dry
51.5	52			~~LIMESTON~~ SHALE, dark gray (N3), soft.
52	55			LIMESTONE, hard, gray (N7). dry
55	61			LIMESTONE, medium, gray (N7). dry
61	119			LIMESTONE, gray, hard, occasional soft
				spots (~71', 73', 78') and (109')
* 119	119.5			SHALE, dark gray (N3), soft, water bearing
				zone (?)
119.5	152			LIMESTONE hard, gray (N7)

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SAMPLE/CORE LOG (Cont.d)

Boring/Well ~~P-6D~~ MW-34D JH 12/19/97

Page 2 of 2

Prepared By J. KIRKPATRICK

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
152	152.5	Rock chips + hammer noise		LIMESTONE, softer spot, dark gray
152.5	160			LIMESTONE, hard, gray (N7)
160	160.5			LIMESTONE, soft, gray
160.5	168.			LIMESTONE, gray, hard
* 168	170			LIMESTONE, medium hard to soft, calcite veins (possible water bearing zone - 1/6th gpm)
170	~~180~~ 181			LIMESTONE, hard, gray (N7)
		181	TOTAL DEPTH	

Jason Kirkpatrick
6-21-95

G&M Form 04 6-86

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000093 JH 12/19/97

GERAGHTY & MILLER, INC.
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SAMPLE/CORE LOG

Boring/Well MW-35 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/ 8 /97 Drilling Completed 8/ 8 /97

Total Depth Drilled 11.5 feet Hole Diameter 6 inches Type of Sample/ Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. ~~11.5~~ 542.46 JH 12/19/97 feet ☒ Surveyed ☐ Estimated Datum ~~542.46~~ FT AMSL

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper HAL / CHUCK

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
0	2	1.5	19/22/29/29	FLUE DUST	ND
2	4	0.5	28/50/.5	FLUE DUST	ND
4	8	CUTTINGS		RUBBLE & FLUE DUST SLIGHT CHEMICAL ODOR (NO OVM HITS)	ND
8	10	1.5	2/5/7/12	CLAY, LIGHT ORANGE (10YR 7/6) SLIGHT BROWN (5YR 5/6) MOTTLED	ND
				STIFF, SLIGHTLY MOIST, NO ODOR (CL)	
10	12	1.5	10/12/14/50	BROKEN ROCK AT 11.5	ND
				CLAY AS 8-10 (CL)	

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SAMPLE/CORE LOG

Boring/Well MW-35 Project/No. Sloss Industries / TF0320.015 Page 1 of 2

Site Location Birmingham, AL Drilling Started 8/ 11 /97 Drilling Completed 8/13 /97

Total Depth Drilled 17/42 feet Hole Diameter 6"/6" inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device NA Sampling Interval NA feet

Land-Surface Elev. 542.46 ~~4.5~~ (JH) feet ☒ Surveyed ☐ Estimated Datum ~~542.46~~ JH FTAMSL

Drilling Fluid Used POTABLE H_2O + AIR Drilling Method AIR ROTARY / HAMMER

Drilling Contractor Graves Service Company, Inc. Driller JOHN Helper DWIGHT/ALTON/RON

Prepared By Joe Hughes Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	11.5	—	—	SEE HOLLOW STEM AUGER LOG
11.5	15.5	ROTARY AIR	CUTTINGS	LIMESTONE, MED GRAY (N7), BROKEN & FRACTURED
15.5	17			HARD LIMESTONE, MED GRAY (N7), FINE GR
				RECRYSTALIZED
				CASING SET TO 17 FT BLS
17	19	AIR HAMMER		LIMESTONE, MED GRAY (N7), FN GR, HARD
19	20			LIMESTONE, MED GRAY (N7), FN GR, MEDIUM TO SOFT HARDNESS
20	23			LIMESTONE AS 17-19 W/ TRACE CALCITE FILLED VEINS
23	27			VERY HARD LIMESTONE, MED GRAY (N7), W/ THIN BEDDED
				LIMESTONE, NO CALCITE
27	29			AS 19-20
29	32.75			LIMESTONE, MED GRAY (N7), FN GR, VERY HARD
32.75	33			SOFT SPOT/FRACTURED LIMESTONE W/ SMALL PIECE OF CALCITE
				FILLED VEIN
33	36			AS 23-27
36	37			LIMESTONE, MED GRAY (N7) VERY HARD W/ SOME CALCITE FILLED VEINS
				& SOME DRY BROWN CLAY/SHALE
37	39			AS 29-32.75

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Environmental Services

SAMPLE/CORE LOG (Cont.d)

Boring/Well MW-35 Page 2 of 2

Prepared By Joe Hughes

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
39	41	AIR		LIMESTONE, MED GRAY (N7), VERY HARD, w/
		HAMMER		SOME CALCITE FILLED VEINS (39.25 - CRACK)
				RECRYSTALLIZED, FN GR
41	42			AS 29 - 32.75
				TD 42 FT

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SAMPLE/CORE LOG

Boring/Well ~~P-5~~ MW-36 (JH 12/19/97) Project/No. TF0320.013 Page 1 of 1

Site Location SLOSS - BIRMINGHAM, ALA Drilling Started 6/16/95 Drilling Completed 6/16/95

Total Depth Drilled 12.5 feet Hole Diameter 7 1/4 inches Type of Sample/Coring Device S/S

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONT feet

Land-Surface Elev. 530.34 feet ☒ Surveyed (KT 2/6/96) ☐ Estimated Datum MSL

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor GRAVES Driller RON Helper DANNY / HAL

Prepared By J. HUGHES Hammer Weight 140 Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	TIP
0	2	1.5	1/1/1/1	CLAY, MODERATE BROWN → GRAYBROWN, PLASTIC, SATURATED, NO ODOR, COLOR CHANGE AT ± 1 FT BLS (M BROWN → GYBROWN) (CH)	ND
					ND
2	4	1.5	2/2/4/5	CLAY, LIGHT BROWN, STIFF, MOIST, NO ODOR (CL-CH)	
4	6	1.5	4/7/8/10	CLAY, DARK YELLOWISH ORANGE, STIFF, MOIST, NO ODOR, W/ SOME BLACK (ORGANIC SILT) (CL)	ND
6	8	1.5	8/12/11/14	CLAY, DARK YELLOWISH ORANGE, STIFF, SATURATED AT 7 FT BLS DRY → MOIST ? 7 FT BLS, NO ODOR, W/ IRON CONCRETIONS, GRAVEL (ANGULAR) AND BLACK ORGANIC SILT (CL)	ND
8	10	1.75	6/7/11/12	CLAY, MOTTLED, DARK YELLOWISH ORANGE, GRAYISH ORANGE & VERY PALE ORANGE, STIFF, DRY, NO ODOR W/ BLACK ORGANIC MATTER (ROOTS) & SILT (CL)	ND
10	12	1	2/1/7/8	CLAY, SAME AS ABOVE, STIFF, DRY, NO ODOR W/ BLACK (ORGANIC SILT), & MODERATE RED MOTTLING (CL), BOTTOM OF SPOON IS WET	ND
12.5	14.5		50	1/2 INCH OF PENETRATION W/ 50 BLOWS, LS FRAGMENTS	—

G&M Form 03.6.86

~~000088~~ JH 12/19/97

Southpoint 89-1257

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well ~~P-5~~ MW-36 JH 12/19/97 Project/No. TF0320013 SLOSS INDUSTRIES Page 1 of 1

Site Location BIRMINGHAM ALABAMA Drilling Started 6-20-95 Drilling Completed 6-23-95 1130

Total Depth Drilled 137 feet Hole Diameter 9 7/8" 0-15.5 ~~6 1/8 15.5-137~~ inches Type of Sample/ Coring Device NONE

Length and Diameter of Coring Device NONE Sampling Interval NONE feet

Land-Surface Elev. 530.34 feet (KT) 2/6/96 ☒ Surveyed ☐ Estimated Datum MSL

Drilling Fluid Used AIR Drilling Method AIR HAMMER

Drilling Contractor GRAVES SERVICE CO. Driller JOHN MITCHELL Helper J.B/ DWIGHT

Prepared By J. KIRKPATRICK Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	12.5			SEE O.B. LOG FOR P-5 (JOE HUGHES)
				CLAY, brown to yellowish brown, stiff
12.5	14.5			LIMESTONE, gray (N7 to N6) medium hard
				broken + fractured.
14.5	49.0			LIMESTONE, gray, hard, competent, fine grained
				SURFACE CASING SET - BOTTOM AT 15.5' bls.
49.0	50.5			LIMESTONE, olive gray (5 Y 4/1), soft
50.5	60.0			LIMESTONE, gray, hard.
60.0	61.0			LIMESTONE, gray, soft to medium hard.
61	110			LIMESTONE, light gray, hard.
110	110.5			L.S., soft
110	132			LIMESTONE, gray (N7), hard + medium
				hard.
* 132	132.5			LIMESTONE, medium gray w/ calcite veins,
				soft. (water zone ~ 2-3 gpm)
132.5	137			LIMESTONE, gray, hard.

James K. Kirkpatrick
6-23-95

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well MW-37 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/8/97 Drilling Completed 8/8/97

Total Depth Drilled 10 feet Hole Diameter 6 inches Type of Sample/Coring Device SPLIT SPOON

Length and Diameter of Coring Device 2' x 2" Sampling Interval CONTINUOUS feet

Land-Surface Elev. 535.3 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used NONE Drilling Method HSA

Drilling Contractor Graves Service Company, Inc. Driller RON Helper CHUCK / HAR

Prepared By Joe Hughes Hammer Weight 140 Hammer Drop 30 inches

	Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description	OVM
	0	2	1.5	4/5/4/2	CORE OVERLYING 0.25' CLAY, LIGHT BROWN 5YR5/6, STIFF DRY (CL)	ND
	2	4	1.5	2/3/3/4	CLAY AS 0-2, moist plastic (CH)	ND
*	4	6		4/5/6/8	CLAY light brown 5YR5/6 w/ pale olive 10Y6/2 mottling, stiff, moist, no odor (CL)	ND
not [illegible]	6	8	1.0	7/10/10/12	CLAY AS ABOVE + CLAY, very stiff, grayish orange 10YR7/4 w/ pale olive 10Y6/2 mottling, moist, no odor, bedded look? (CL)	ND
1020 *	8	10	1.75	4/8/11/11	CLAY grayish orange 10YR7/4 w/ pale olive 10Y6/2 & light brown 5YR5/6 mottling, stiff, no odor, moist (CL)	ND
	10	12	0.25	50/3	AUGER REFUSAL AT 10. ROCK AT 10'	

G&M Form 03 6-86

Southprint 87-1718

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SAMPLE/CORE LOG

Boring/Well MW-37 Project/No. Sloss Industries / TF0320.015 Page 1 of 1

Site Location Birmingham, AL Drilling Started 8/7/97 Drilling Completed 8/11/97

Total Depth Drilled 30 feet Hole Diameter 10" inches Type of Sample/Coring Device NA

Length and Diameter of Coring Device NA Sampling Interval — feet

Land-Surface Elev. 535.36 feet ☒ Surveyed ☐ Estimated Datum FT AMSL

Drilling Fluid Used POTABLE H_2O + AIR Drilling Method AIR ROTARY

Drilling Contractor Graves Service Company, Inc. Driller JOHN Helper RON / ALTON

Prepared By Joe Hughes Hammer Weight NA Hammer Drop NA inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	10			SEE HOLLOW STEM AUGER LOGS
10.5	11.5		AIR ROTARY	LIMESTONE, MED GRAY (N7), FRACTURED
11.5	12.75	CUTTINGS		LIMESTONE, MED GRAY (N7), HARD
12.75	13.75			LIMESTONE, MED GRAY, HARD, FRACTURED
13.75	15.0			LIMESTONE, HARD, MED GRAY (N7), MINOR TO
				TRACE CALCITE FILLED VEINS
				STEEL CASING SET TO 15 FT BLS
15	18.25			LIMESTONE (MED GRAY N7), HARD, DRY
18.25				FRACTURED LIMESTONE (MED GRAY (N7))
				w/ CALCITE FILLED VEINS. MAKES GOOD H_2O (15-20 GPM)
19.25				LIMESTONE, SOFT (FRACTURE), LESS CALCITE THAN
				18.25
21	23.5			LIMESTONE, MED GRAY (N7) MEDIUM HARD
23.5	30			LIMESTONE, MED GRAY (N7), HARD
				SOFT SPOT AT 25 & 29.

VOLUME I

APPENDIX A.5

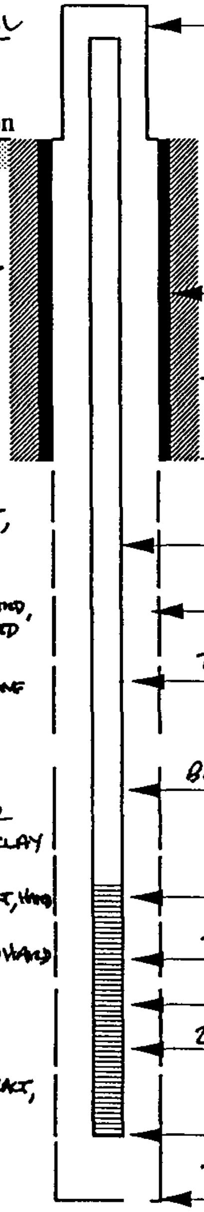
WELL CONSTRUCTION LOGS

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries | Site Location: Birmingham, Alabama
Well Location: NE ACCESS ROAD TO SAND MOUNTAIN
Project No.: TF0320.015 | Well/~~Piezometer~~ No. MW-21
Contractor: Graves Service Company Inc. | Driller(s): JOHN MITCHELL
Drilling Method(s): Hollow Stem Auger/Air Rotary | Helper(s): DWIGHT/ALTON/RON | SWMU Area: LD
Prepared By: Joe Hughes | Date(s) Installed: 8/6/97 TO 8/9/97 | SWMU: 23

Survey Datum: TOC 558.85 AMSL

Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)

0
CLAY STIFF TO PLASTIC, DK/TOMOY (CL-CH)
8 LINE
9'
CLAY, STIFF, LIGHT BROWN (CL)
23
LIMESTONE, FRACT, HARD
28.5
LIMESTONE MED HARD, FRACT w/CALCITE FILLED VEINS
29.5
CLAY w/LIMESTONE
30.25
LIMESTONE
32
LIMESTONE, HARD FRACT 31.75 TO 32
33.75
LIMESTONE, MED w/CLAY
34.75
LIMESTONE, FRACT, HARD
36.75
LIMESTONE, MED HARD
37.75
LIMESTONE, FRACT, HARD
42

Item	Value
Type of Protective Cover	STEEL
ID of Surface Casing	NA
Type of Surface Casing	NONE
Diameter of Borehole	10"
Depth Bottom of Surface Casing	NA
Type of Riser Pipe	2" PVC SCH 40
Diameter of Borehole	10"
Type of Grout Around Riser Pipe	TYPE I-II (12+8 BAGS)
Depth Top of Seal	24
Type of Seal	BENTONITE PELLETS (2 BUCKETS)
Depth Bottom of Seal	27
Depth Top of Screen	29
Screen Section Material	2" PVC SCH 40
Screen Size	0.010 SLOT
Type of Sand Pack Around Screen	20/30 SAND (16 BAGS)
Depth Bottom of Screen	39
Depth Bottom of Borehole/Sandpack	41 SAND / 42 FILL

REMARKS:
NO PLACE TO SET SURFACE CASING

GERAGHTY & MILLER, INC.
Environmental Services

GROUNDWATER PIEZOMETER REPORT

Client Sloss Industries
Location Birmingham, Alabama
Project No. TF0320.013
Contractor GRAVES
Drilling Method(s) AIR ROTARY
Prepared By J. HUGHES
Driller(s) JOHN M
Helper(s) JB/DWIGHT P.
Date(s) Installed 7/19/95 - 7/20/95

MW-22
Boring No. P-31
JU 12/19/97

Survey Datum 628.86 ft amsl

KD 2/6/96
Ground Elevation 625.70 ft amsl

GENERAL SOIL CONDITIONS (Not to Scale)

0 SANDSTONE
8.5 CLAY
9 SANDSTONE
13.5 CLAY
S.S STRINGERS 22.75-28.5
28.5 SHALE/CLAY
S.S STRINGER 34.75-35
LIGHT BROWN TO GRAY (36)
72 BLACK SILT (COAL?)
72.5 SHALE/CLAY GRAY BROWN (76-83)
83 SANDSTONE TO SILTSTONE
MINOR L.S. 102-104.5
104.5 LIMESTONE, w/ CALCITE FILLED FRACTURES MINOR S.S & SILTSTONE
109.5 CLAY -> SHALE/CLAY S.S STRINGER 111.5
114.5 LIMESTONE W/ CALCITE FILLED FRACTURES & FOSSILS
119

Item	Value
Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	N/A
Diameter of Borehole	6 1/8"
Depth Bottom of Surface Casing	N/A
Type of Riser Pipe	2" PVC
Diameter of Borehole	6 1/8"
Type of Grout Around Riser Pipe	TYPE I-II PORTLAND CEMENT
Depth Top of Seal	103.5
Type of Seal	BAROID 3/8" BENTONITE PELLETS
Depth Bottom of Seal	106
Depth Top of Screen	108.5
Type of Screen Section	2" PVC
Type of Sand Pack Around Screen	PERMA 20/30
Depth Bottom of Screen	118.5
Depth Bottom of Borehole/Sandpack	119

REMARKS:
± 150 GALLONS ADDED TO BOREHOLE TO CLEAN CUTTINGS OUT OF BOREHOLE.

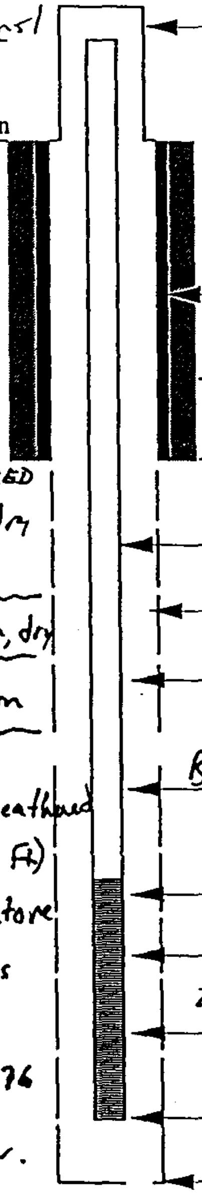
GERAGHTY & MILLER, INC.
Environmental Services

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No. TF0320.013
Contractor: GRAVES SERVICE CO.
Drilling Method(s): AIR ~~HAMMER~~/ROTARY
Prepared By: J. KIRKPATRICK
Driller(s): DWIGHT PRUIT ~~JOHN MITCHELL~~ JK 7-27-95
Helper(s): J. BUTLER
Date(s) Installed: JULY 27 1995

Boring No. ~~P-30~~ MW-23 JK 12/19/97

Survey Datum 635.88 ft amsl
KP 2/6/96
Ground Elevation 632.94 ft amsl



GENERAL SOIL CONDITIONS (Not to Scale)

CLAY, reddish brown, dry
— 38.0 —
CLAY or WEATHERED SHALE, gray, dry
— 53.0 —
SHALE, lite brown, dry
— 55.0 —
SANDSTONE, brown
— 57.0 —
SHALE, gray, weathered w/ lenses (<1 ft) of gray sandstone thoughout this interval.
Hard spot at ~76 seems to be making water.

Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	NONE
Diameter of Borehole	NA
Depth Bottom of Surface Casing	NONE
Type of Riser Pipe	SCH 40 PVC
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	PORTLAND TYPE I
Depth Top of Seal	64.7
Type of Seal	Bentonite Pellets
Depth Bottom of Seal	67.0
Depth Top of Screen	68.5
Type of Screen Section	SCH 40 PVC (#10 SLOT) 0.010"
Type of Sand Pack Around Screen	20/30 Silica Sand
Depth Bottom of Screen	78.5
Depth Bottom of Borehole/Sandpack	79.0

REMARKS:

Used 50 gallons of potable water to clean out bore hole.

GERAGHTY & MILLER, INC.
Environmental Services

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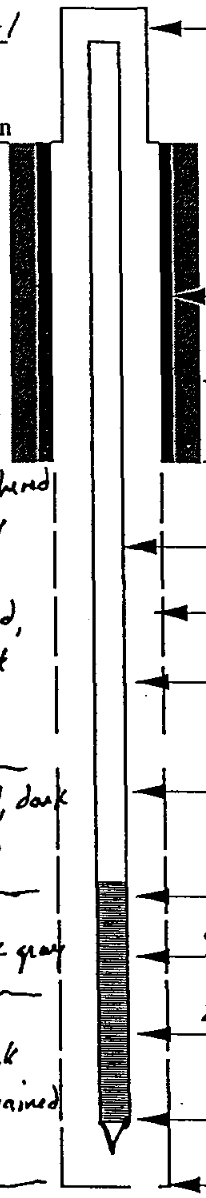
~~000205~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No.: TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): DWIGHT PRUITT
Drilling Method(s): AIR ROTARY / HAMMER
Helper(s): JOHN BUTLER
Prepared By: J. KIRKPATRICK
Date(s) Installed: JULY 26 1995

Boring No. MW-29 ~~P-29~~ JH 12/19/97

Survey Datum: 594.99 ft amsl
(S) 2/6/96
Ground Elevation: 591.81 ft amsl



GENERAL SOIL CONDITIONS (Not to Scale)

General Soil Conditions	Value	Item
	4" STEEL	Type of Protective Cover
CLAY, reddish brown, stiff	NONE	ID of Surface Casing / Type of Surface Casing
	NA	Diameter of Borehole
— 21.0 —	NONE	Depth Bottom of Surface Casing
SHALE, highly weathered (like clay) gray	SCH 40 PVC	Type of Riser Pipe
— 29.0 —	6"	Diameter of Borehole
SHALE, weathered, gray, still not very hard.	PORTLAND TYPE 1	Type of Grout Around Riser Pipe
— 54.5 —	59.0	Depth Top of Seal
SHALE, weathered, dark gray, becomming harder	Bentonite Pellets	Type of Seal
	61.1	Depth Bottom of Seal
— 66.75 —	63.3	Depth Top of Screen
SHALE, hard, dark gray	SCH 40 PVC (0.010" SLOT) #10	Type of Screen Section
— 69.0 —	20/30 Silica Sand	Type of Sand Pack Around Screen
SANDSTONE, dark gray, medium grained very hard.	JK 7-16-95 ~~73.0~~ 73.3	Depth Bottom of Screen
— 76.0 —	76.0	Depth Bottom of Borehole/Sandpack

REMARKS:

Had ~2 ft of fall-in on the bottom of borehole, accumulated between pulling the rods + installing the well. Should have no effect on well.

GERAGHTY & MILLER, INC.
Environmental Services

~~000201~~ SH 12/19/97

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GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries

Location: Birmingham, Alabama

Project No.: TF0320.013

Contractor: GRANEY

Drilling Method(s): AIR ROTARY

Prepared By: J. HUGHES

Driller(s): JOHN M.

Helper(s): JB/DWIGHT

Date(s) Installed: 7/14 → 18/95

Boring No.: MW-25S ~~P-25D~~

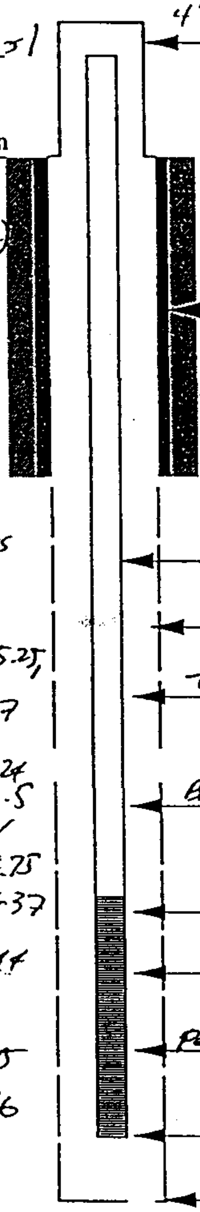
S

Jkt 12/15/97 7-25-95

Survey Datum: 559.67 ft amsl

(R) 2/6/96

Ground Elevation: 556.76 ft amsl



GENERAL SOIL CONDITIONS (N: Scale)

0 SILT + SAND (FILL MATERIAL)

18 CLAY w/ L.S. RUBBLE

28 L.S.

HARD, SOFT, & BROKEN IN SPOTS

HARD 24-25, 34.75-35.25

SOFT 35.25-37

BROKEN 22.75-24, 25-26.5, 27-31, 31-34.75, 35.25-37

HARD → SOFT 37-44

BROKEN 44-45.75

HARD 45.75-46

Type of Protective Cover	4" STEEL
ID of Surface Casing	6"
Type of Surface Casing	STEEL
Diameter of Borehole	10
Depth Bottom of Surface Casing	32
Type of Riser Pipe	2" PVC
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	TYPE I-II
Depth Top of Seal	31
Type of Seal	BAROID 3/8" BENTONITE PELLETS
Depth Bottom of Seal	33.5
Depth Top of Screen	35.5
Type of Screen Section	2" PVC 0.010 SLOT
Type of Sand Pack Around Screen	PETAL 20/30 SAND
Depth Bottom of Screen	45.5
Depth Bottom of Borehole/Sandpack	46

REMARKS:

50 GAL H_2O ADDED TO CLEAN BOREHOLE

GERAGHTY & MILLER, INC. Environmental Services

000202 JH 1/6/...

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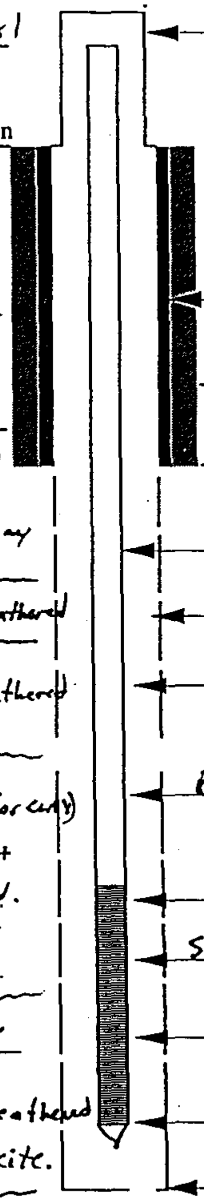
GROUNDWATER PIEZOMETER REPORT

Client	Sloss Industries
Location	Birmingham, Alabama
Project No.	TF0320.013
Contractor	GRAVES SERVICE CO.
Driller(s)	DWIGHT PRUITT
Drilling Method(s)	AIR ROTARY
Helper(s)	JOHN BUTLER
Prepared By	J. KIRKPATRICK
Date(s) Installed	JULY 26, 1995
Boring No.	MW-25D ~~P-28D~~ JH 12/19/97

Survey Datum 559.63 ft amsl
KB 2/6/96
556.89 ft ams Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)

Soil conditions	Construction	
	4" STEEL	Type of Protective Cover
CLAY and LIME FILL		
— 23.0 —	6+" STEEL	ID of Surface Casing / Type of Surface Casing
L.S. broken, weathered	9 7/8" (10")	Diameter of Borehole
— 29.0 — L.S. hard, gray — 31.0 —	31.0	Depth Bottom of Surface Casing
L.S. broken, gray some calcite — 37.0 —	SCH 40 PVC	Type of Riser Pipe
CLAY or SHALE, weathered — 39.0 —	6"	Diameter of Borehole
L.S. broken, weathered gray. — 44.0 —	PORTLANT TYPE 1	Type of Grout Around Riser Pipe
L.S and Shale (or clay) in lenses (1-2 ft thick), all med. gray color, all weathered.	51.9	Depth Top of Seal
	Bentonite Pellets	Type of Seal
	54.1	Depth Bottom of Seal
	56.3	Depth Top of Screen
— 63.0 —	SHC 40 PVC (0.010" SLOT) #10	Type of Screen Section
L.S., hard, gray — 64.0 —	20/30 Silica Sand	Type of Sand Pack Around Screen
L.S. broken, weathered	66.3	Depth Bottom of Screen
gray, w/ calcite. — 67.0 —	67.0	Depth Bottom of Borehole/Sandpack

REMARKS:

Washed out borehole w/ 50 gallons of water.

GERAGHTY & MILLER, INC. Environmental Services

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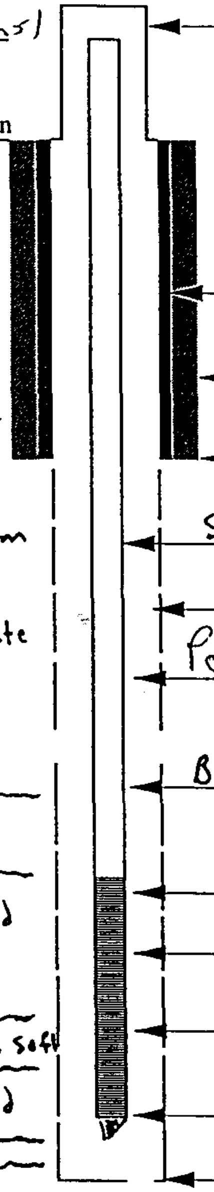
~~000203~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No.: TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): JOHN MITCHELL
Drilling Method(s): AIR HAMMER
Helper(s): J.B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 20 1995

Boring No. ~~P-27~~ MW-26 JH 12/19/97

Survey Datum: 549.58 ft amsl
KT 2/6/96
Ground Elevation: 547.41 ft amsl



Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	6" Steel
Diameter of Borehole	8 3/4"
Depth Bottom of Surface Casing	24'
Type of Riser Pipe	SCH 40 PVC
Diameter of Borehole	5 3/4"
Type of Grout Around Riser Pipe	Portland Type I KK
Depth Top of Seal	124.3
Type of Seal	Bentonite Pellets
Depth Bottom of Seal	126.9
Depth Top of Screen	130.5
Type of Screen Section	SCH 40 PVC (0.010") #10 SLOT
Type of Sand Pack Around Screen	20/30 Silica
Depth Bottom of Screen	140.5
Depth Bottom of Borehole/Sandpack	141.0

GENERAL SOIL CONDITIONS (Not to Scale)

CLAY,
— 22.0 —
LIMESTONE, fine grained, medium gray (N6), occasional calcite veins
— 83.0 —
L.S./SHALE, soft
— 91.0 —
L.S., gray, hard
— 100.0 —
SHALE, gray brown, soft
— 105.0 —
L.S., gray, hard
— 135 —
SHALE
— 136 —
L.S.

REMARKS:

GERAGHTY & MILLER, INC.
Environmental Services

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~~000201~~ JH 12/19/97

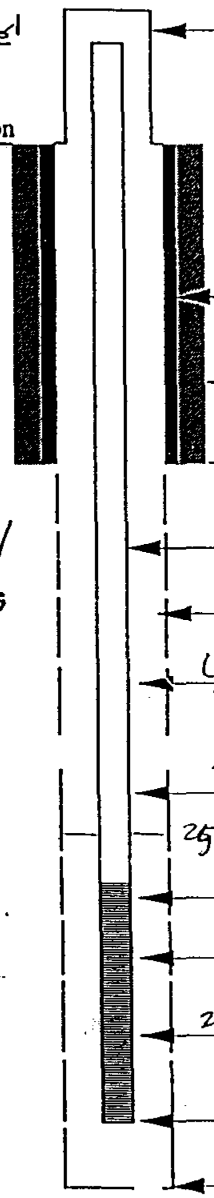
GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No. TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): John Mitchel
Drilling Method(s): Air Hammer
Helper(s): JB & DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: 6-13-95 DRILLED

Boring No. MW-27 ~~P-26~~ JH 12/19/97

Survey Datum ~~554.09~~ 554.97 ft amsl JH 12/19/97
KT 2/6/96

Ground Elevation 552.02 ft amsl



GENERAL SOIL CONDITIONS (No Scale)

CLAY, red orange, w/ gravel.

23.0

Limestone gray, hard w/ Calcite seams

37.0

Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	6" Steel
Diameter of Borehole	9 7/8"
Depth Bottom of Surface Casing	25.5
Type of Riser Pipe	2" PVC
Diameter of Borehole	5 3/4"
Type of Grout Around Riser Pipe	LEHIGH PORTLAND CEMENT TYPE I-II
Depth Top of Seal	23.1
Type of Seal	BENTONITE PELLETS (3/8")
Depth Bottom of Seal	25.55
Depth Top of Screen	27.0
Type of Screen Section	0.010 2" PVC
Type of Sand Pack Around Screen	20/30 PEARL SAND 50LB BAG
Depth Bottom of Screen	37.0
Depth Bottom of Borehole/Sandpack	37.0

REMARKS:
4-50 LB BAGS OF 20/30 SAND USED
1/3-5 GAL BUCKET OF 3/8" BENTONITE PELLETS
6-94 BAGS OF TYPE I-II CEMENT

GERAGHTY & MILLER, INC. Environmental Services

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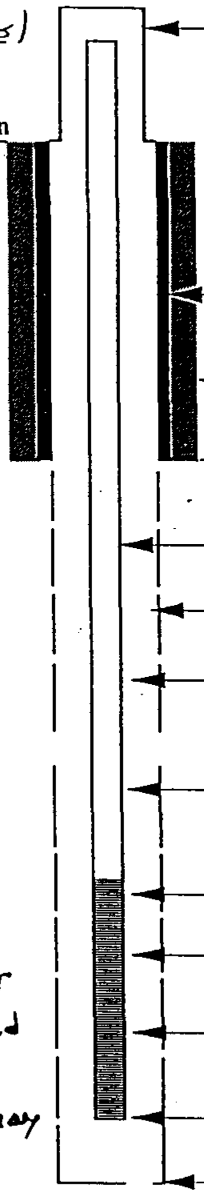
~~000200~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No.: TF0320.013
Co-tractor: GRAVES SERVICES CO.
Driller(s): John Mitchell
D-ig Method(s): AIR HAMMER
Helper(s): J. B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 15, 1995

Boring No. MW-28 ~~P-25~~ JH 12/19/97

Survey Datum 558.32 ft msl
KA 2/6/96
Ground Elevation 556.44 ft msl



GENERAL SOIL CONDITIONS (Not to Scale)

CLAY
Reddish brown

18'

LIMESTONE, gray, hard,

(52-53)
LIMESTONE, SOFT w/ calcite filled veins.

53'
LIMESTONE, gray hard

4" STEEL	Type of Protective Cover
NONE	ID of Surface Casing
	Type of Surface Casing
9"	Diameter of Borehole
NONE	Depth Bottom of Surface Casing
SCH 40 PVC	Type of Riser Pipe
6 1/4"	Diameter of Borehole
PORTLAND TYPE I	Type of Grout Around Riser Pipe
43.0	Depth Top of Seal
Bentonite pellets	Type of Seal
46.0	Depth Bottom of Seal
48.0	Depth Top of Screen
SCH 40 PVC 0.010" SLOT	Type of Screen Section
20/30 SILICA SAND	Type of Sand Pack Around Screen
58.0	Depth Bottom of Screen
58.0	Depth Bottom of Borehole/Sandpack

REMARKS:

GERAGHTY & MILLER, INC.
Environmental Services

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~~000199~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries Site Location: Birmingham, Alabama

Well Location: ½ WAY BETWEEN MW-30S&D & MW-28 ± 80 FT W OF FENCE

Project No. TF0320.015

Contractor: Graves Service Company Inc. Driller(s): JOHN MITCHELL

Drilling Method(s): Hollow Stem Auger/Air Rotary Helper(s): RON / ALTON / DWIGHT

Prepared By: Joe Hughes Date(s) Installed: 8/7/97 TO 8/12/97

Well/Piezometer No. MW-29

SWMU Area: LD

SWMU: 38

Survey Datum: TOC 563.89 amsl

Ground Elevation

GENERAL SOIL CONDITIONS (Not to Scale)

Depth	Soil Conditions
0	COKE
3	CLAY + COKE FILL MATERIAL
11	CLAY, LIGHT BROWN, STIFF (CL)
21.5	LIMESTONE, MED GRAY, BROKEN, HARD
22	LIMESTONE HARD + CLAY
24.5	LIMESTONE HARD
25.25	CLAY
25.5	LIMESTONE, HARD — TEMP CASING
26	LIMESTONE HARD
27	CAVITY
28	LIMESTONE, MED
29	LIMESTONE, HARD, w/ CALCITE
30.5	SOFT SPOT
31	LIMESTONE w/ DOLOMITIZED AREAS, ABUNDANT CALCITE FILLED VEINS, STRUCTURAL FEATURES (SLICKENSIDES) & DISSOLVED APPEARANCE (CALCITE STANDS OUT FROM MATRIX)
34.5	
38	

Item	Value
Type of Protective Cover	STEEL
ID of Surface Casing	NA
Type of Surface Casing	TEMPORARY CASING
Diameter of Borehole	9"
Depth Bottom of Surface Casing	NA
Type of Riser Pipe	2" PVC SCH 40
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	TYPE I-II (8 BAGS)
Depth Top of Seal	22
Type of Seal	BENTONITE PELLETS (1 BUCKET)
Depth Bottom of Seal	24
Depth Top of Screen	26
Screen Section Material	2" PVC SCH 40
Screen Size	0.010 SLOT
Type of Sand Pack Around Screen	20/30 SAND (9 BAGS)
Depth Bottom of Screen	36
Depth Bottom of Borehole/Sandpack	36.5

4" BOREHOLE — 38

REMARKS:

MAKES 10-12 GPM (EST.)

GERAGHTY & MILLER, INC. *Environmental Services*

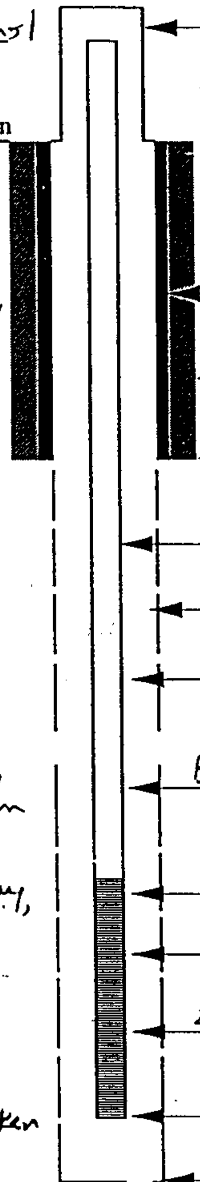
GROUNDWATER PIEZOMETER REPORT

Client	Sloss Industries
Location	Birmingham, Alabama
Project No.	TF0320.013
Contractor	GRAVES SERVICE CO.
Driller(s)	J. Mitchell
Drilling Method(s)	AIR HAMMER
Helper(s)	J.B / DWIGHT
Prepared By	J. KIRKPATRICK
Date(s) Installed	6-20-95
Boring No.	MW-30S ~~P-24S~~ JH 12/19/97

Survey Datum 564.68 ft amsl

KT 2/1/96

562.21 ~~564.68~~ ft msl Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)

CLAY, yellow, reddish brown,

20.3

LIMESTONE gray, hard

22.75 – 24.5 L.S. soft, olive brown

LIMESTONE gray, hard

33.5 – 35.0 L.S. broken gray w/ dolomite streaks.

Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	NONE
Diameter of Borehole	8 3/4"
Depth Bottom of Surface Casing	NONE
Type of Riser Pipe	SCH 40 PVC
Diameter of Borehole	5 3/4"
Type of Grout Around Riser Pipe	Portland Type I KT
Depth Top of Seal	20.9
Type of Seal	Bentonite pellets
Depth Bottom of Seal	22.8
Depth Top of Screen	24.5
Type of Screen Section	SCH 40 PVC 0.010" SLOT (#10)
Type of Sand Pack Around Screen	~~20/30 Silica~~
Depth Bottom of Screen	34.5
Depth Bottom of Borehole/Sandpack	35.0

REMARKS:

GERAGHTY & MILLER, INC. Environmental Services

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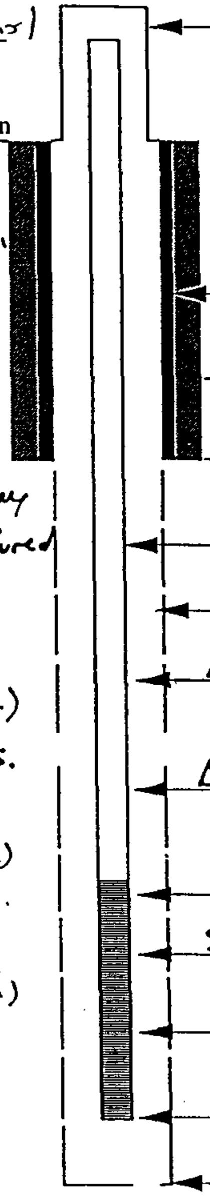
GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No.: TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): JOHN MITCHELL
Drilling Method(s): AIR HAMMER
Helper(s): J.B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 16, 1995

Boring No. ~~P-24 D~~ MW-30D
JD 12/19/97

Survey Datum: 564.43 ft amsl
KP 2/6/96
562.26 ft amsl Ground Elevation



Value	Item
4" STEEL	Type of Protective Cover
NONE	ID of Surface Casing / Type of Surface Casing
NA ~~NONE~~ JWK 1-16-95	Diameter of Borehole
NONE	Depth Bottom of Surface Casing
SCH 40 PVC	Type of Riser Pipe
5 3/4"	Diameter of Borehole
PORTLAND TYPE 1	Type of Grout Around Riser Pipe
34.6	Depth Top of Seal
Bentonite Pellets	Type of Seal
37.9	Depth Bottom of Seal
48.5	Depth Top of Screen
SCH 40 PVC 0.010" (# 10 SLOT)	Type of Screen Section
20/30 Silica	Type of Sand Pack Around Screen
58.5	Depth Bottom of Screen
59.0	Depth Bottom of Borehole/Sandpack

GENERAL SOIL CONDITIONS (Scale)

CLAY, reddish orange, tight w/ gravel.
19.0
LIMESTONE, gray hard but fractured
22.0 L.S. Fractured
26.0 (water zone)
28.5 Softer L.S.
39.0 L.S., softer
46.0 (water zone)
Hard L.S.
53 L.S. soft
55 (water zone)
Hard L.S.
57 L.S. soft
59 (water)

REMARKS:

GERAGHTY & MILLER, INC.
Environmental Services

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~~000193~~ JG 12/...

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries   Site Location: Birmingham, Alabama

Well Location: AT SOUTH WESTERN END OF SWMU 39

Project No.: TF0320.015

Contractor: Graves Service Company Inc.   Driller(s): JOHN MITCHELL

Drilling Method(s): Hollow Stem Auger/Air Rotary   Helper(s): ALTON/DWIGHT/KEN

Prepared By: Joe Hughes   Date(s) Installed: 8/6/97 TO 8/13/97

Well/~~Piezometer~~ No.: MW-31

SWMU Area: LD

SWMU: 39

Survey Datum: TOC 571.52 FT AMSL

Ground Elevation

GENERAL SOIL CONDITIONS (Not to Scale)

Depth	Description
0	FLUE DUST + SOME CLAY
14	FILL (METAL, CONCRETE)
15	LIMESTONE, FRACT, HARD
17	LIMESTONE HARD
21	LIMESTONE BROKEN + VERY STIFF CLAY, MOIST
22	CLAY AS 21-22
	LIMESTONE, FRACT
26	LIMESTONE, VERY HARD, LITTLE CALCITE
28.5	LIMESTONE, MED HARD, FRACTURED, W/ SOME WEATHERED LIMESTONE
29	LIMESTONE, HARD, SOFT AT 33-33.25
35	LIMESTONE SOFT
38	LIMESTONE, HARD
41	LIMESTONE, MED SOFT
44.25	LIMESTONE HARD
47	

Item	Value
Type of Protective Cover	STEEL
ID of Surface Casing	6"
Type of Surface Casing	STEEL
Diameter of Borehole	10"
Depth Bottom of Surface Casing	19'
Type of Riser Pipe	2" PVC SCH 40
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	TYPE I-II (8+ BAGS)
Depth Top of Seal	32
Type of Seal	BENTONITE PELLETS (1/2 BUCKET)
Depth Bottom of Seal	34
Depth Top of Screen	36.5
Screen Section Material	2" PVC SCH 40
Screen Size	0.010
Type of Sand Pack Around Screen	20/30 SAND 4 BAGS
Depth Bottom of Screen	46.5'
Depth Bottom of Borehole/Sandpack	47

REMARKS:

BOREHOLE MADE 5 TO 10 GPM FROM 35 TO 47 INTERVAL

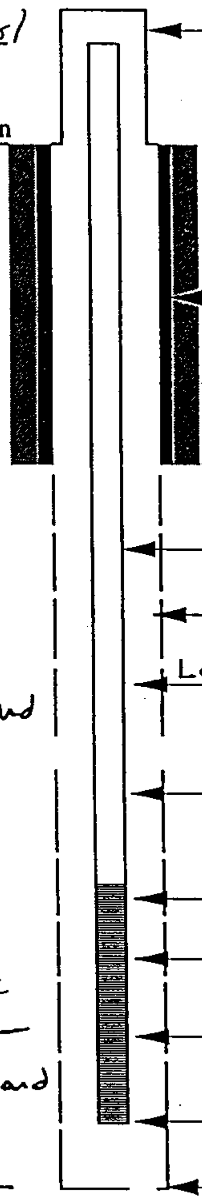
GERAGHTY & MILLER, INC.
Environmental Services

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No. TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): JOHN BUTLER
Drilling Method(s): AIR HAMMER
Helper(s): J.B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 21 1995

Boring No. ~~MW-32~~ PT
JH 12/19/97

Survey Datum 569.43 ft amsl
KB 2/6/96
Ground Elevation 567.24 ft amsl



Type of Protective Cover	4" STEEL	
ID of Surface Casing / Type of Surface Casing	6" STEEL	
Diameter of Borehole	9 7/8"	
Depth Bottom of Surface Casing	23.0	
Type of Riser Pipe	SCH 40 PVC	
Diameter of Borehole	6 1/8"	
Type of Grout Around Riser Pipe	Lehigh Portland Cement Type I-II	
Depth Top of Seal	32.2	
Type of Seal	Bentonite Pellets	
Depth Bottom of Seal	34.7	
Depth Top of Screen	37.0	
Type of Screen Section	SCH 40 PVC 0.010" SLOT (#10)	
Type of Sand Pack Around Screen	20/30 Silica	
Depth Bottom of Screen	47.0	
Depth Bottom of Borehole/Sandpack	47.5	

GENERAL SOIL CONDITIONS (Not to Scale)

SILTY SAND, black to brown (flue dust)
8.5
LIMESTONE
11.5
SILTY SAND, black creosote odor
18.5
L.S, gray
19.5
SILTY SAND
22.0
LIMESTONE, hard gray
42.5
* L.S w/ calcite
43.0
LIMESTONE, hard gray
47.5

REMARKS:

* water zone

GERAGHTY & MILLER, INC.
Environmental Services

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~~000178~~ JH 12/19/97

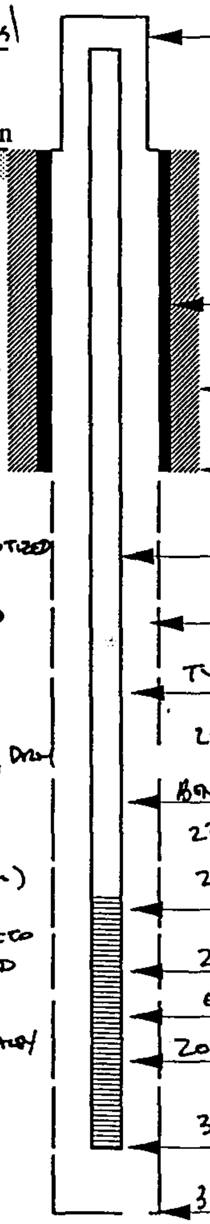
GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Site Location: Birmingham, Alabama
Well Location: 1/2 WAY BETWEEN MW-32 & 35 ON WEST SIDE OF ROAD
Project No.: TF0320.015
Contractor: Graves Service Company Inc.
Driller(s): JOHN
Drill Method(s): Hollow Stem Auger/Air Rotary
Helper(s):
Prepared By: Joe Hughes
Date(s) Installed: 8/8/97 TO 8/11/97

Well/~~Piezometer~~ No. MW-33
SWMU Area: LD
SWMU: 39

Survey Datum: 556.73 ft amsl

Ground Elevation



Depth	General Soil Conditions (Not to Scale)
0	
	FLUE DUST
	SATURATED AT 4 FT
10	CLAY, PALE OLIVE w/ LIGHT BROWN MOTTLING, w/ ROUNDED PEBBLES) (CL)
14	LIMESTONE HARD, FRACTURED, DOLOMITIZED IN AREAS
20	LIMESTONE HARD MOD TO SOFT
2-	LIMESTONE HARD
26.5	LIMESTONE, HARD, DRY
29.5	SOFT SPOT H_2O BEARING (4-5GPM)
33	SOFT SPOT TRACE TO SOME CALCITE FILLED VEINS
34.5	LIMESTONE, SHALEY SOFT
38	LIMESTONE, HARD
39	

Item	Value
Type of Protective Cover	STEEL
ID of Surface Casing	6"
Type of Surface Casing	STEEL
Diameter of Borehole	10"
Depth Bottom of Surface Casing	26.5
Type of Riser Pipe	2" PVC SCH 40
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	TYPE I-II (5 BAGS)
Depth Top of Seal	25
Type of Seal	BENTONITE PELLETS (1/2 BUCKET)
Depth Bottom of Seal	27
Depth Top of Screen	29
Screen Section Material	2" PVC SCH 40
Screen Size	0.010 SLOT
Type of Sand Pack Around Screen	20/30 SAND (4 BAGS)
Depth Bottom of Screen	39
Depth Bottom of Borehole/Sandpack	39.5

REMARKS:

GERAGHTY & MILLER, INC. Environmental Services

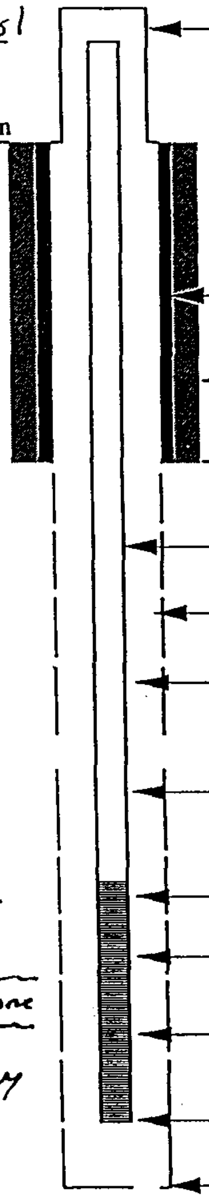
GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No.: TF0320.013
Contractor: GRAVES SERVICES
Driller(s): JOHN MITCHELL
Drilling Method(s): AIR HAMMER
Helper(s): J.B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 26 1995

Boring No. ~~P-6S~~ MW-34S (JH) 12/19/97

Survey Datum 545.98 ft amsl (KJ) 2/6/96

Ground Elevation 543.84 ft amsl



GENERAL SOIL CONDITIONS (Not to Scale)

CLAY
— 11.25 —
L.S. Broken, Soft
— 15.0 —
L.S. hard, gray, fine grained
— 29.5 —
* L.S. — water zone
— 30.25 —
L.S. Hard, gray

Type of Protective Cover	4" STEEL
ID of Surface Casing / Type of Surface Casing	6+" STEEL
Diameter of Borehole	9 7/8"
Depth Bottom of Surface Casing	16.0
Type of Riser Pipe	SCH 40 PVC
Diameter of Borehole	6 1/8"
Type of Grout Around Riser Pipe	PORTLAND TYPE I
Depth Top of Seal	19.4
Type of Seal	Bentonite
Depth Bottom of Seal	21.5
Depth Top of Screen	24.0
Type of Screen Section	SCH 40 PVC (0.010" SLOT)
Type of Sand Pack Around Screen	20/30 Silica
Depth Bottom of Screen	34.0
Depth Bottom of Borehole/Sandpack	34.5

REMARKS:

* water zone

GERAGHTY & MILLER, INC.
Environmental Services

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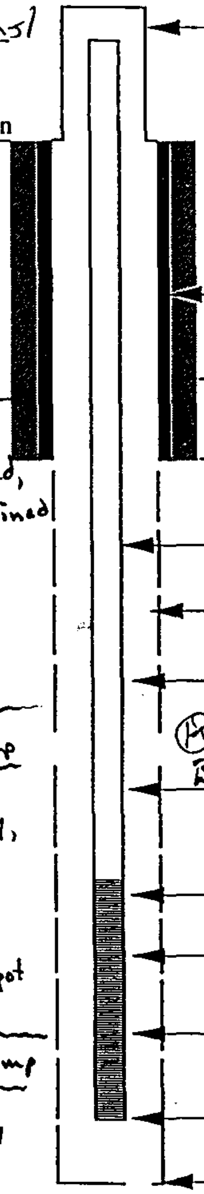
000178 ~~KJ~~ (JH) 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No. TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): JOHN MITCHELL
Drilling Method(s): AIR HAMMER
Helper(s): JB / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 21 1995

Boring No. ~~P-6D~~ MW-34D
JH 12/19/97

Survey Datum: 546.10 ft amsl
KB 2/6/96
544.00 ft amsl Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)		Value	Item
		4" STEEL	Type of Protective Cover
CLAY,		6" STEEL	ID of Surface Casing / Type of Surface Casing
		9 7/8"	Diameter of Borehole
12.0		16.0	Depth Bottom of Surface Casing
L.S., gray, hard, dry, fine grained		SCH 40 PVC	Type of Riser Pipe
		5 3/4"	Diameter of Borehole
		Portland Type I	Type of Grout Around Riser Pipe
119.0 SHALE, soft, damp 119.5	KB	160 ~~58~~	Depth Top of Seal
		Bentonite	Type of Seal
LIMESTONE, gray, hard.		164 ?	Depth Bottom of Seal
		168	Depth Top of Screen
152-152.5 - soft spot		SCH 40 PVC (0.010" SLOT)	Type of Screen Section
168.0 L.S. w/ calcite, damp 170.0		20/30 Silica	Type of Sand Pack Around Screen
LIMESTONE, gray		178	Depth Bottom of Screen
		181	Depth Bottom of Borehole/Sandpack

REMARKS: Took a long time for sand to settle out through the viscous slough at bottom. Sand pushed the viscous slough up the borehole as it settled out. The bentonite bridged at the top of the slough at ~138 ft bls. Bentonite was tagged at ~160 ft bls on June 22, 1995. KB

GERAGHTY & MILLER, INC.
Environmental Services

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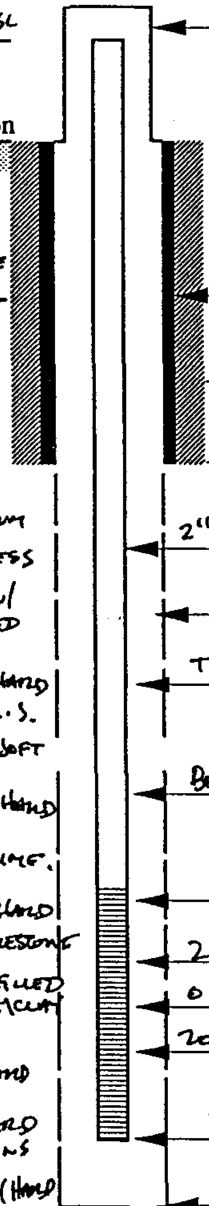
~~000177~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client	Sloss Industries	Site Location	Birmingham, Alabama
Well Location	Near Pipeline ± 500 ft South/North of Access Road Gate		
Project No.	TF0320.015	Well/Piezometer No.	MW-35
Contractor	Graves Service Company Inc.	Driller(s)	John Mitchell
Drilling Method(s)	Hollow Stem Auger/Air Rotary	Helper(s)	Aaron / Dwight / Ron
Prepared By	Joe Hughes	Date(s) Installed	8/8/97 to 8/14/97
SWMU Area	LD	SWMU	39

Survey Datum: 542.12 FT AMSL

Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)

Depth	Soil Conditions
0	Flue dust
8	Clay Gray/ish orange (CL) & Brown mottled stiff, slightly moist
11.5	Broken rock limestone
15.5	Limestone, hard
19	Limestone medium to soft hardness
20	Limestone, hard, w/ minor calcite filled veins
23	Limestone, very hard w/ thin bedded L.S.
27	Limestone, med to soft
29	Limestone very hard
32.75	Soft spot fractured lime.
33	Limestone very hard with thin bedded limestone
34	Limestone w/ calcite filled veins & some clay/shale/clay very hard
37	Limestone very hard
39	Limestone very hard w/ some calcite veins
41	Limestone very hard
42	

Value	Item
Steel	Type of Protective Cover
6"	ID of Surface Casing
Steel	Type of Surface Casing
10"	Diameter of Borehole
17	Depth Bottom of Surface Casing
2" PVC Sch 40	Type of Riser Pipe
6"	Diameter of Borehole
Type I-II (3 Bags)	Type of Grout Around Riser Pipe
15	Depth Top of Seal
Bentonite Pellets (1/2 Bucket)	Type of Seal
17.5	Depth Bottom of Seal
19.5	Depth Top of Screen
2" PVC Sch 40	Screen Section Material
0.010 Slot	Screen Size
20/30 Sand (3.5 Bags)	Type of Sand Pack Around Screen
29.5	Depth Bottom of Screen
30.5	Depth Bottom of Borehole/Sandpack

Bentonite 34.5 (1 Bucket)
Sand 42 (2.5 Bags)

REMARKS:

GERAGHTY & MILLER, INC.
Environmental Services

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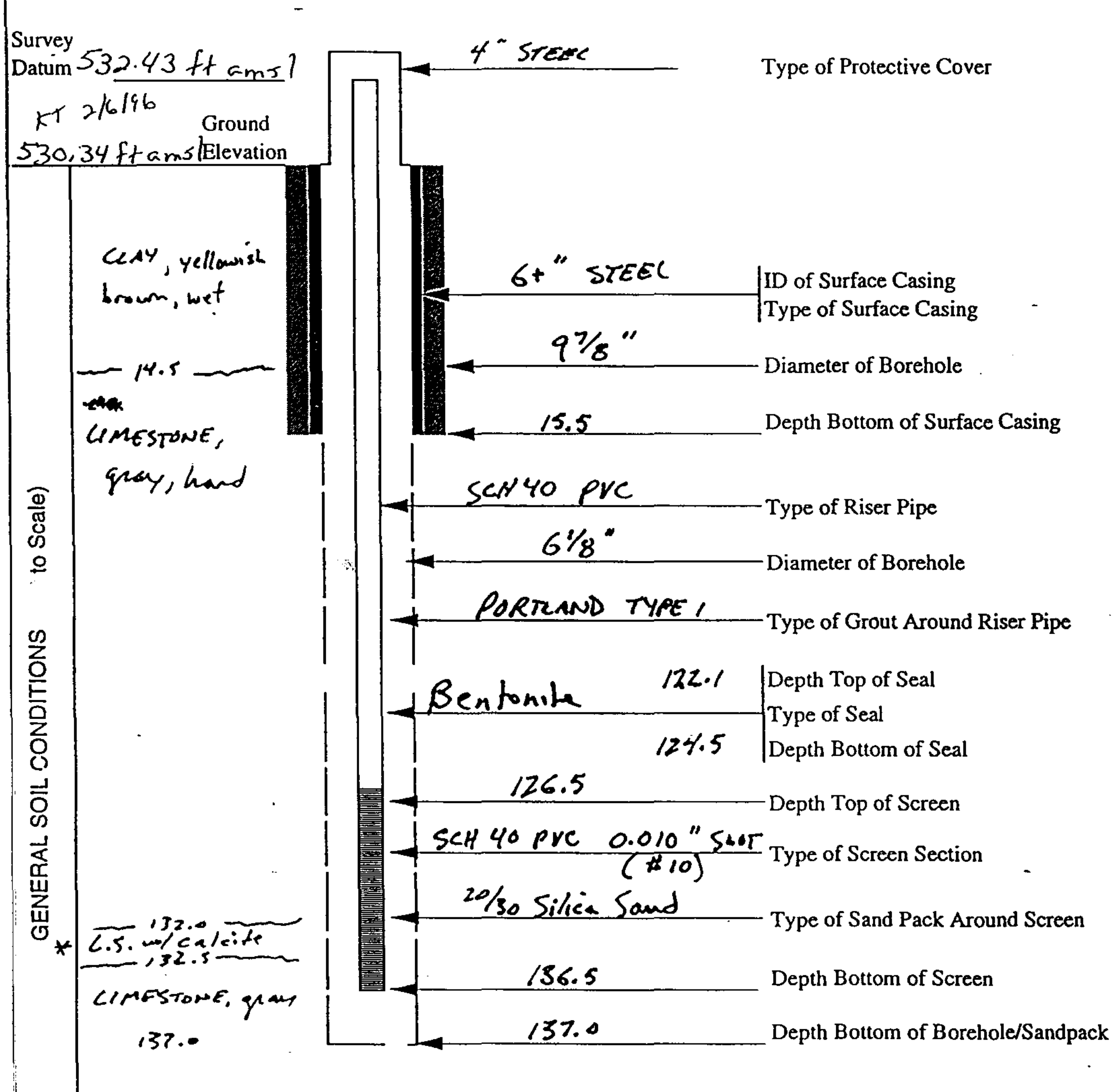
GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries
Location: Birmingham, Alabama
Project No. TF0320.013
Contractor: GRAVES SERVICE CO.
Driller(s): JOHN MITCHELL
Drilling Method(s): AIR HAMMER
Helper(s): J.B / DWIGHT
Prepared By: J. KIRKPATRICK
Date(s) Installed: JUNE 23 1995

Boring No. ~~P-5~~ MW-36 JH 12/19/97



REMARKS:

* water zone

GERAGHTY & MILLER, INC. Environmental Services

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~~000175~~ JH 12/19/97

GROUNDWATER PIEZOMETER REPORT

Client: Sloss Industries — Site Location: Birmingham, Alabama

Well Location: AT NE END OF SWMU

Project No.: TF0320.015

Contractor: Graves Service Company Inc. — Driller(s): JOHN MITCHELL

Drilling Method(s): Hollow Stem Auger/Air Rotary — Helper(s): RON, ANTON, DWIGHT

Prepared By: Joe Hughes — Date(s) Installed: 8/8/97 TO 8/11/97

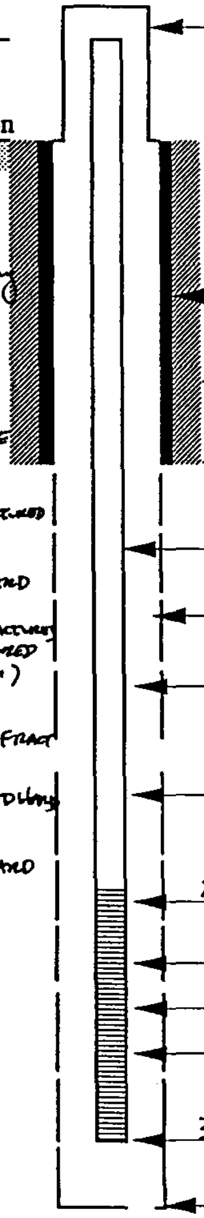
Well/Piezometer No.: MW-37

SWMU Area: LD

SWMU: 38

Survey Datum: TOC 537.44

Ground Elevation



GENERAL SOIL CONDITIONS (Not to Scale)

Depth	Soil Conditions
0–2	COKE
	CLAY, light brown w/ pale olive mottling, stiff, moist ('CL')
10.5	FRACTURED LIMESTONE
11.5	LIMESTONE, HARD
12.75	
13.75	LIMESTONE, FRACTURED
	LIMESTONE, HARD
18.25	CALCITE FILLED FRACTURES LIMESTONE, FRACTURED MAKES (15-20GPM)
19.25	LIMESTONE, SOFT, FRAC LESS CALCITE
21	LIMESTONE, MEDIUM
23.5	LIMESTONE, HARD SOFT AT 25 & 29
30	

Item	Value
Type of Protective Cover	STEEL
ID of Surface Casing	6
Type of Surface Casing	STEEL
Diameter of Borehole	10"
Depth Bottom of Surface Casing	15'
Type of Riser Pipe	2" PVC SCH40
Diameter of Borehole	6"
Type of Grout Around Riser Pipe	TYPE I-II (3 BAGS)
Depth Top of Seal	14.5
Type of Seal	BENTONITE PELLETS (½ BUCKET)
Depth Bottom of Seal	16.5
Depth Top of Screen	20
Screen Section Material	2" PVC
Screen Size	0.010
Type of Sand Pack Around Screen	20/30 (4.5 50LB BAGS)
Depth Bottom of Screen	30
Depth Bottom of Borehole/Sandpack	30.5'

REMARKS:

GERAGHTY & MILLER, INC. *Environmental Services*

VOLUME I

APPENDIX A.6

WELL DEVELOPMENT LOGS

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.015 Well: MW-21
Location: Birmingham, Alabama Site ID SWMU-23
Client: Sloss Industries Prepared by: J. Hughes

Method/Equipment:

Static DTW 14.93 TD 41.88 Pumping DTW ______ (ft below MP)

Pumping Rate ______ gpm Pumping Duration: ______

Specific Capacity ______ gpm/ft Q = ± 1.5 GPM

Water Removed During Development 40 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
9/5/97	940	7.56	1.05	20	Turbid >200	1 mg/L	20
	1030	7.71	1.02	23	Turb >200	5.2	30
	1100	8.05	1.05	24	Turb >200	7.5	35
	1125	7.99	1.03	24	Turb >200	7.2	37.5
	1150	7.85	1.01	24	25.5	7.2	40.0

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: ______

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DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

MW-22 JH 12/19/97

Project Name/No. Sloss Industries TF0320.013 Well: ~~P-3+~~
Location: Birmingham, Alabama Site ID
Client: Sloss Industries Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH ~121 ft bTOC

1 volume = 6.6 gallons
5 Volumes = 33 gallons
+225 gal.

Static DTW 94.17 Pumping DTW ~110. (ft below MP)

Pumping Rate 1 1/4 to 1 1/2 gpm Pumping Duration: ~4 hours

Specific Capacity NA gpm/ft

Water Removed During Development 275 gallons

$\boxed{\text{STARTED - 1115}}$
8/11/95

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	WATER LEVEL
8/12/95	1200	6.71	520	21	10	2.44	55	
8/14/95	2100	6.72	490	19	50	2.45	65	
8/14/95	2135	6.90	390	19	50	3.00	110	
8/14/95	2150	6.74	420	19	10	2.66	140	
8/14/95	2210	6.74	490	19	10	2.40	165	
8/14/95	2230	6.76	500	19	5	2.74	195	
8/14/95	2250	6.77	450	19	5	2.41	220	STOPPED PUMPING
8/15/95	0820	6.70	550	19	10	3.14	243	STARTED PUMPING 0811
8/15/95	0845	6.73	490	19	5	3.01	275	

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

VOLUME CALC.

121.00
94.17
26.83

26.8
.16
1608
2680

6.6
5
330

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JH 12/19/97

000240

DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No.: Sloss Industries TF0320.013
Well: ~~R-30~~ MW-23 JH 12/19/97
Location: Birmingham, Alabama
Site ID:
Client: Sloss Industries
Prepared by: J. KIRKPATRICK

Method/Equipment: $\boxed{\text{TOTAL DEPTH - 81.8}}$

1 Volume - 7.4 gallons
5 Volumes - 37 gallons

Static DTW: 35.19 Pumping DTW: NA (ft below MP)

Pumping Rate: NA gpm Pumping Duration: Pumped dry repeatedly

Specific Capacity: NA gpm/ft

Water Removed During Development: 52 gallons

SPEC. CAP.
1 min. - 40.1
10 min. - 56.2

WATER LEVEL AFTER RECOVERY

STARTED: 1215
8/10/95

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped		WATER LEVEL
8/10/95	1235	5.54	160	22	>1000	0.96	15		
8/10/95	1300	5.77	160	22	>100	1.60	22		went dry
8/11/95	~~1030~~ 1030	5.55	150	21	>100	1.62	35	pumped dry	37.
8/11/95	1335	5.63	170	22	>100	1.36	45		37.4
8/13/95	1355	5.57	140	22	>100	1.43	52	pumped dry	

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

VOLUME CALC.

81.80
35.19
46.61

46.6
.16
2796
4660
7.456

7.4
5
37.0

JH 12/19/97

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~~000312~~

DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013
Location: Birmingham, Alabama
Client: Sloss Industries

Well: ~~P-29~~ MW-24 (JH) 12/19/97
Site ID
Prepared by: J. KIRKPATRICK

1 Volume - 9.7 gallons
5 Volumes - 48.5 gallons.

Method/Equipment: TOTAL DEPTH - 76.50

Static DTW 15.59 Pumping DTW Pumped dry repeatedly (ft below MP)

Pumping Rate 1/2 gpm Pumping Duration: NA

Specific Capacity NA gpm/ft

Water Removed During Development 58 gallons

SPEC. CAP.
1 min - 21.9
10 min - 58.2

STARTING WATER LEVEL AFTER RECOVERY

STARTED - 1020
8/10/95

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped		WATER LEVEL
8/10/95	1045	5.82	320	22	>1000	1.03	16		
8/10/95	1115	5.94	290	22	>1000	3.15	20	Pumped dry	
8/11/95	1730	5.71	320	22	>100	3.77	32	Pumped Dry	15.9
8/13/95	1205	6.02	370	24	>100	6.26	45	Pumped Dry	16.03
8/14/95	1040	5.88	310	24	50	2.30	55		17.59
8/14/95	1100	5.89	310	24	50	3.61	58	Pumped dry	

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

VOLUME CALC.

76.50
15.59
60.91

60.9
.16
3654
[illegible]

9.7
5
485

(JH) 12/19/97

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000311

DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No.	Sloss Industries TF0320.013	Well:	MW-25S ~~P-20S~~ JH 12/19/97
Location:	Birmingham, Alabama	Site ID	
Client:	Sloss Industries	Prepared by:	J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 48.8 ft BTOC

1 Volume = 4.2 gallons
5 Volumes = 21.0 gallons + 75 gallons

Static DTW 22.45 Pumping DTW see below (ft below MP)

Pumping Rate 1/2 to 1/4 gpm
rate is fluctuating

Pumping Duration: 2 hrs.

Specific Capacity NA gpm/ft

SPEC. CAP.
1 min - 27.65
10 min - 40.1

Water Removed During Development 90 gallons

STARTED - 0945
8-14-95

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	WATER LEVEL
8-14-95	1015	6.92	710	24	50	1.25	20	41.2
8-14-95	1045	7.01	720	24	50	4.07	38	44.3
8-14-95	1115	6.96	730	24	40	3.48	55	42.3
8-14-95	1145	6.96	750	24	30	2.61	~~80~~ 70	42.6
8-14-95	1220	6.92	740	24	30	2.48	90	42.1

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

48.80
22.45
26.35

26.4
.16
1584
2640
4.224

1 Volume - 4.2
5
21.0

~~000309~~ JH 12/19/97

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GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013 | Well: ~~P-28D~~ MW-25D JJ 12/19/97
Location: Birmingham, Alabama | Site ID
Client: Sloss Industries | Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 70.1 ft bTOC
1 Volume - 7.8 gallons
5 Volumes - 39 gallons. + 75 gal.

Static DTW 21.45 Pumping DTW NA (ft below MP)

Pumping Rate 1/2 to 1/4 gpm Pumping Duration: Pumped dry repeatedly

Specific Capacity NA gpm/ft

SPEC. CAP.
1 min - 35.1
10 min - 61.1

Water Removed During Development 50 gallons

STARTED - 0820
8-14-95

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped		WATER LEVEL
8/14/95	0845	11.81	4360	25	>1000	3.88	12	Pumped dry	~70
8/14/95	1900	11.61	2130	25	100	2.88	23	Pumped dry	21.58
8/15/95	0930	11.19	1110	25	100	4.23	33	Pumped dry	18.
8/15/95	1820	10.84	660	25	80	3.09	38		24.6.
8/15/95	1830	10.90	600	25	80	4.13	41	Pumped dry	
8/16/95	1830	10.88	600	25	85	—	50	Pumped dry	

STATIC WATER LEVEL AFTER RECHARGE

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

70.1
21.45
48.65

48.7
.16
2922
487

7.8
5
39.0

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GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013
Location: Birmingham, Alabama
Client: Sloss Industries

Well: ~~P-27~~ MW-26 12/19/97
Site ID
Prepared by: J. HUGHES

Method/Equipment: TOTAL DEPTH - 142 ft bTOC

1 Volume - 8.22
5 Volumes - 40 gallons

Static DTW 90.65 Pumping DTW NA (ft below MP)

Pumping Rate 1/2 to 1/4 to start gpm Pumping Duration: Pumped dry repeatedly or Bailed dry repeatedly

Specific Capacity NA gpm/ft

Water Removed During Development 14 gallons

STARTED - 1020
8-3-95

Water Quality and Observations

DEPTH TO WATER AFTER RECHARGE

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped		
								140	
8/3	1035	8.59	980	25	>1000	1.50	~~8.5~~ 6		
8/3/95	1115	8.53	1060	21	>1000	1.71	12		pumped dry
8/12/95	1600	8.60	1020	24	>1000	→	13		pumped dry
8/14/95	1500	8.04	1640	25	>1000	3.87	13.5	140	bailed dry
8/15/95	1400	7.97	1780	25	>1000	4.64	13.75	141	bailed dry
8/26/95	1500	8.06	1760	25	>1000	4.02	14.00	141	bailed dry

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: Very slow recharge - will continue development w/ a bailer. (Sheen on water)

142.00
90.65
51.35

51.35
.16
3084
5140
8224

8.22 1 volume

g:\proj\tf320\tbl\welldev.xls

~~000308~~ 12/19/97

DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No.	Sloss Industries TF0320.013	Well:	~~P-26~~ MW-27 JH 12/19/97
Location:	Birmingham, Alabama	Site ID	
Client:	Sloss Industries	Prepared by:	J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 39.4   1 Volume - 3.4   5 Volumes - 17.5

Static DTW 17.75 Pumping DTW ~18 (see below) (ft below MP)

Pumping Rate 1 gpm Pumping Duration: 1 hour

Specific Capacity NA gpm/ft

Water Removed During Development 55 gallons

SPEC. CAPACITY:
1 min - 18.40
10 min - 18.20

STARTED: 1115

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	WATER LEVEL
8/9/95	1125	6.62	770	21	<10 NTU's	0.72	10	18.21
8/9/95	1135	6.66	840	21	<10	0.84	25	18.12
8/9/95	1145	6.63	800	21	<10	0.72	32	18.11
8/9/95	1155	6.62	850	21	<10	0.80	43	18.16
8/9/95	1210	6.65	840	21	<10	0.56	55	

reduced rate slightly

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: NO WATER ADDED DURING DRILLING

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VOLUME CALC.

39.40 − 17.75 = 21.65

21.6 × .16 = 1296, 2160

3.5 × 5 = 17.5

000307 12/19/97

DONE

GERAGHTY & MILLER, INC. Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013
Location: Birmingham, Alabama
Client: Sloss Industries

Well: ~~R-25~~ MW-28 JH 12/19/97
Site ID
Prepared by: J. HUGHES

Method/Equipment:

Static DTW 19.98 Pumping DTW 25.80 (1 MIN) 28.29 (10 MIN) 28.52 (20 MIN) 28.71 (35 MIN) 50 GAL (ft below MP)

Pumping Rate ~ 1½ gpm Pumping Duration: 1.25 HR

Specific Capacity NA gpm/ft

Water Removed During Development 55 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
7/20/95		6.94	610	25	3.06	3.34	10
		6.94	630	25	2.04	3.04	20
		6.99	630	25	1.41	2.86	43
		6.96	510	25	1.57	2.42	55

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: No drilling water added.

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~~000306~~ JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.015 Well: MW-29
Location: Birmingham, Alabama Site ID SWMW 38
Client: Sloss Industries Prepared by: J. Hueiteg

Method/Equipment:

Static DTW 20.25 Pumping DTW 20.54 (ft below MP)

Pumping Rate ______ gpm Pumping Duration: ______

Specific Capacity ______ gpm/ft TD 30.85

Water Removed During Development 100 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
8/18/92	1320	7.05	0.69	23	2200	1.2	5
	1325	7.86	0.55	23	14.45	1.3	15
	1340	7.55	0.51	22	16.85	3.8	50
	1345	7.50	0.50	22	16.68	1.5	55
	1405	7.53	0.48	22	2200*	1.5	65
	1415	7.52	0.47	22	18.7	1.7	75
	1420	7.53	0.53	22	75.4 B	1.5	85
	1425	7.45	0.53	22	60.6	2.4	105

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: * TURB UP, AFTER RESTARTING PUMP
B · METER MALFUNCTION

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DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013
Location: Birmingham, Alabama
Client: Sloss Industries

Well: ~~P-24S~~ MW-30 S JH 12/19/97
Site ID
Prepared by: J. [illegible]ES

Method/Equipment:

Static DTW 25.56 Pumping DTW 27.01 (1MIN) 27.10 (10MIN) 21.17 (20MIN) (ft below MP) (48GAL IN 20MIN)

Pumping Rate ~1 gpm Pumping Duration: 1 HR

Specific Capacity NA gpm/ft

Water Removed During Development 55 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
7/28/95		6.70	580	25	17.7	7.90	10
↓		6.75	680	25	6.97	6.04	20
↓		6.73	630	25	4.93	4.98	30

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: No drilling water added.

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~~000304~~ JH 12/19/97

DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013 Well: ~~P-240~~ MW-30D JH 12/19/97
Location: Birmingham, Alabama Site ID
Client: Sloss Industries Prepared by: J. HUGHES

Method/Equipment:

Static DTW 24.85 Pumping DTW 29.70 (1 MIN) 33.51 (10 MIN) 33.95 (30 MIN) 33.95 (38 MIN) (ft below MP)

Pumping Rate ~1/2 gpm Pumping Duration: 2

Specific Capacity NA gpm/ft

Water Removed During Development 55 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
7/27/95		7.13	420	23	97.3	2.46	10
↓		7.10	520	22	9.09	6.71	20
		7.17	500	22	5.41	6.01	30

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: No water added during drilling.

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~~000305~~ JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.015 Well: MW-31
Location: Birmingham, Alabama Site ID [illegible]
Client: Sloss Industries Prepared by: [illegible]

Method/Equipment:

Static DTW 19.92 Pumping DTW 49.27 (ft below MP)

Pumping Rate ______ gpm Pumping Duration: ______

Specific Capacity ______ gpm/ft

Water Removed During Development 55 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	
8/5/97	1555	7.33	0.62	25	98.3*	2.7	20	
	1605	7.37	0.57	26	105.4*	2.0	25	GPM ≅ 0.5
	1615	7.39	0.60	26	40.5	1.7	30	"
	1620	7.58	0.62	24	3.1	3.0	35	IN GPM TO ≅ 1
	1630	7.43	0.58	26	2.3	1.7	40	"
	1635	7.62	0.62	25	179.9*	2.2	45	GPM ≅ 0.5
	1645	7.63	0.62	25	28.6* aem	1.7	47.5	"
	1650	7.62	0.61	24	5.6	1.6	50	GPM ≅ 1
	1655	7.62	0.58	24	4.3	1.4	52.5	"
	1700	7.63	0.62	24	4.1	1.7	56	"

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: * METER MALFUNCTION

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DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013 Well: ~~P-7~~ MW-32 JH 12/19/97
Location: Birmingham, Alabama Site ID
Client: Sloss Industries Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 49.9 BTOC JWK 8-29-95 1 Volume = 5 gal. 5 Volume = 25 gal

Static DTW 18.64 Pumping DTW ~~48~~ (ft below MP)

Pumping Rate 1/2 to 3/4 gpm Pumping Duration: 2 hrs.

Specific Capacity NA gpm/ft

Water Removed During Development 55 gallons

SPEC. CAP.
1 min — 28.90
10 min - 34.55

STARTED : 1430

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
8/8	1440	6.72	1970	25	5.4	1.21	8
8/8	1455	6.63	2040	24.5	5.4	1.33	18
8/8	1517	6.61	2070	24	3.0	1.02	24
8/8	1535	6.62	2060	23	0.9	0.96	35
8/8	1610	6.65	2030	23	0.8	1.00	~~50~~ 46
8/8	1625	6.66	2040	23	0.9	1.02	55

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: No water added during drilling.

49.90
18.64
31.26

31.3
.16
1878
3130

5.0
5
25.0 Gallons.

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JH 12/19/97
~~000285~~

GERAGHTY
& MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. **Sloss Industries** TF0320.015 Well: Mw-33
Location: **Birmingham, Alabama** Site ID SWMU 39
Client: **Sloss Industries** Prepared by: [illegible]

Method/Equipment:

Static DTW 7.96 41.40 Pumping DTW 31.86 (ft below MP)

Pumping Rate 1.37 gpm Pumping Duration: 1.25 Hrs

Specific Capacity ______ gpm/ft

Water Removed During Development 110 gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
8/16/97	915	6.43	0.87	23	2.63	1.7	20
	935	6.80	0.77	23	4.2	1.1	40
	950	6.55	0.88	23	6.1	3.3	55
	1005	6.45	0.93	23	29.9	1.3	75
	1020	6.48	0.96	23	30.7	2.2	95
	1030	6.51	0.92	23	6.6	3.5	105
	1035	6.49	0.93	23		2.2	110

1.37
80) 110
80
300
240
600
560

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

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DONE

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013 Well: ~~P-6S~~ MW-34S JH 12/19/97
Location: Birmingham, Alabama Site ID
Client: Sloss Industries Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 36.4

Static DTW 7.81 Pumping DTW ~~~35~~ JWK 8-29-95 (ft below MP)

SPEC. CAP.
1 min - 11.05
10 min - 14.91

Pumping Rate 1 1/4 gpm Pumping Duration: 1.25 hrs.

Specific Capacity NA gpm/ft

1 Volume = 9.5 gallons
5 Volumes = 47.5 gallons.

Water Removed During Development 110 gallons

47.5 GAL

STARTED : 1200

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	MG/L DO	Gallons Pumped	
8/8	1213	6.53	1640	22	10	1.06	18	
8/8	1226	6.51	1650	22	10	0.96	31	
8/8	1237	6.50	1630	24	10	1.18	46	increase rate to 2 gpm
8/8	1249	6.51	1630	22	10	0.82	65	
8/8	1302	6.51	1640	22	10	0.80	82	
8/8	1318	6.51	1640	22	10	0.83	110	

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: No water added during drilling.

36.40
7.81
28.59

28.6
.16
1716
2860
4576

9.5
5
47.5

JH 12/19/97

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~~000283~~

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013
Location: Birmingham, Alabama
Client: Sloss Industries

Well: ~~P 6 D~~ MW-34D JH 12/19/97
Site ID
Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH ~ ~182'

1 Volume = 11 gallons
5 Volumes = 55 gallons

Static DTW 111.2 Pumping DTW see below (ft below MP)

Pumping Rate 1/2 to 1/4 gpm
rate ↓ as depth ↑

Pumping Duration: Pumped/Bailed dry repeatedly

Specific Capacity NA gpm/ft

Water Removed During Development 25 gallons

STARTED - 1255
8-12-95

INITIAL WATER LEVEL (AFTER RECHARGE at 1/4 gpm pumped dry

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped		
8/12/95	1525	8.20	1210	24	50	0.43	16		
8/13/95	1820	7.96	1330	22	>100	1.83	21		161.5
8/13/95	1640	7.84	1420	22	>100	2.34	22	bailed dry	
8/14/95	1445	7.88	1340	22	>100		23	"	176.[illegible]
8/15/95	1345	7.85	1210	24	>100	5.29	24	"	176.30
8/16/95	1200	8.04	1280	24	>100	—	25	"	
8									

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: 8/12/95 pumped dry (16 gallons) 8/13/95 bailed dry (6 gallons) 8/14/95 Bailed dry (3/4 gallon), 8/15/95 BAILED DRY (1 GALLON)

35.1
14.6
20.5

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~~000284~~ 1 JH 12/19/97

GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.015 Well: MW-35
Location: Birmingham, Alabama Site ID SWMW39
Client: Sloss Industries Prepared by: J. Wedes

Method/Equipment:

Static DTW 6.50 TD 32.30 Pumping DTW ______ (ft below MP)

Pumping Rate ______ gpm Pumping Duration: ______

Specific Capacity ______ gpm/ft

Water Removed During Development ______ gallons

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	
8/16/97	18:05	6.97	1.86	24	>200	6 mg/L	20 gal	
8/17/97		6.97	1.55	25	111.9	3 mg/L	3	BAILED DRY
8/17/97	1925	6.61	1.65	22	110	6.2 mg/L	3	BAILED DRY
8/18/97	18 50	7.03	1.72	23	45	6.5 mg/L	2.5	BAILED DRY
8/19/97	15 40	7.04	1.69	21	6.5	6.0	1	BAILED DRY
							25.5	TOTAL

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

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GERAGHTY & MILLER, INC.
Environmental Services

Done

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.013 Well: ~~P-5~~ MW-36 JA 12/19/97
Location: Birmingham, Alabama Site ID
Client: Sloss Industries Prepared by: J. KIRKPATRICK

Method/Equipment: TOTAL DEPTH - 139' 1 VOLUME - 22.2 gallons. 5 Volumes - 111 gallons.

Static DTW 0.0 (artesian) Pumping DTW see below (ft below MP)

Pumping Rate 1.5 gpm Pumping Duration: 2.5 hrs.

Specific Capacity NA gpm/ft

Water Removed During Development 155 gallons

SPEC. CAP.
At ~4 gpm { 1 min - 8.2
10 min - 45.2

STARTED - 1600

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped	WATER LEVEL
8/9/95	1615	9.06	980	20.5	~100		33	
8/9/95	1640	9.04	950	21	~100	0.77	65	
8/9/95	1700	9.05	950	21	~100	0.54	85	51.5
8/9/95	1730	9.10	970	20.5	<100	1.02	97	50.2
8/9/95	1800	9.10	950	20.5	<100	0.50	135 ← Increased Rate to ~3 gpm	
8/9/95	1815	9.10	970	20.5	<100	0.79	155	60.3

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks: ~25 gallons added during drilling so we will remove an additional 50 gallons.

139
.16
834
1390
2224

22.2
5
111.0

JA 12/19/97

~~000282~~

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GERAGHTY & MILLER, INC.
Environmental Services

WELL DEVELOPMENT SUMMARY

Project Name/No. Sloss Industries TF0320.015 Well: MW-37
Location: Birmingham, Alabama Site ID SWMU 3B
Client: Sloss Industries Prepared by: J. Hughes

Method/Equipment:

Static DTW 3.79 TD 30.20 Pumping DTW 8.71 (ft below MP)

Pumping Rate 1.6 gpm Pumping Duration: 1.0

Specific Capacity ______ gpm/ft

Water Removed During Development 110 gallons

1.6
65) 110
65
450

Water Quality and Observations

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped
8/6/97	1150	6.42	0.69	23	47.5	1.2	30
	1200	6.26	0.67	23	51.3	1.1	55
	1210	6.27	0.68	23	50.9	1.4	75
	1220	6.35	0.64	22	62.0	1.0	95
	1230	6.31	0.64	23	57	1.3	110

Sample

Date	Time	pH	SC	Temperature °C	Visual/ Turbidity	DO	Gallons Pumped

Remarks:

VOLUME I

APPENDIX A.7

WATER LEVEL MEASUREMENTS

MULTIPLE WELL MEASUREMENTS
Sloss Industries
Birmingham, Alabama

	Well Number	Date	Time	Depth to Product	Depth to Water	Remarks
	P-1S	8/7/97	1120		16.60	
	P-1D		1120		17.00	
	P-2		1100		13.92	
	P-3		1100		10.95	
	P-4		1155		11.52	
nw-36	P-5		1330		2.71 Atoc	
1w-345	P-6S		1349		6.37	
w-340	P-6D		1350		5.69	
w-32	P-7		1340		16.84	
	P-8		1343		7.57	
	P-9		1405		162.59	
	P-10		1410		12.50	
	P-11		1413		6.44	
	P-12		1415		6.14	
	P-13S		1417		9.68	
	P-13D		1418		114.83	
	P-14		1430		9.11	
	P-15		1425		5.79	
	P-16		1232		5.52	
	P-17		1220		5.06	
	P-18		1236		11.05	
	P-19S		1245		4.51	
	P-19D		1240		4.27	
	P-20		1247		82.15	
	P-21		1258		121.41	
	P-22		1300		10.56	
	P-23		1305		17.02	
w-305	P-24S		~~21.17~~ 1310		21.17	
nw-30D	P-24D		1310		20.67	
nw-28	P-25		1317		16.31	
nw-27	P-26		1335		16.09	
nw-26	P-27		1333		85.48	
nw-25S	P-28S		1055		17.87	
mw-25D	P-28D		1055		17.17	
mw-24	P-29		1053		12.97	
mw-23	P-30		1050		~~12.97~~ 31.98	
nw-22	P-31		1045		93.62	
	P-32		1255		5.62	
	MW-5		1157			No Reading Wasp (K)
	MW-6					
	SG-1					Knocked own No Reading (K)
	SG-2		1112		1.12	
	SG-3		1130		13.07	
	SG-4	8/7/97	1143		0.96	

Mw-21	1025	15.30
Mw-25	1315	20.55
Mw-31	1338	20.74
Mw-33	1345	8.18
Mw-35	1510	26.33
Mw-37	1505	3.89

(K) 10-28-97

VOLUME I

APPENDIX A.8

GROUNDWATER SAMPLING LOGS

ARCADIS GERAGHTY&MILLER

GERAGHTY & MILLER, INC.
Environmental Services
A Heidemij Company

WATER SAMPLING LOG

Project Name/Number: Sloss Industries / TF0320.015 Page 1 of 20

Site Location: Birmingham, Alabama Site/Well No. MW-21

Sample I.D.: 970818 -LD- 23 -GW0021 Coded/ Replicate No. Date 8 / 18 / 97

Weather: Sunny 90's Purge Begin 1305 Purge Ended 1400 Time Collected 1410

EVACUATION DATA

Description of Measuring Point (MP): TOC

Height of MP Above/Below Land Surface: MP Elevation:

Total Sounded Depth of Well Below MP: 41.88 Water-Level Elevation:

Depth of Water Below MP: 15.25 Diameter of Casing: 2"

Water Column in Well: 26.63 Total Purge Volume: 25

Gallons per Foot: 4.2608 x5 = 21.30 Sampling Pump Intake (feet below MP): 40.00

Gallons in Well: .16

41.88
15.25
26.63
26.63
.16
15978
26630
4.26
5
21.30

Evacuation Method: 2" SUB PUMP

SAMPLING DATA/FIELD PARAMETERS

Color: LT Brown Odor: — Appearance: Sturbid Temperature: 25/25/25 °C

Specific Conductance (mmhos/cm): 1.34/1.26/1.32 pH: 7.07/7.28/7.30 Dissolved Oxygen: 6.0/7.2/7.4 mg/L

Turbidity: >200/>200/28.9 NTUs Eh: mV 10 Gal/15 Gal/25

Other:

CONTAINER DESCRIPTION

Constituents Sampled — From Lab X or G&M — Preservative

Constituents Sampled	Container	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks:

Sampling Personnel: Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

GERAGHTY & MILLER, INC.
Environmental Services
A Heidemij Company

WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 2 of 20

Site Location Birmingham, Alabama Site/Well No. MW-32

Sample I.D. 970818 -LD-23 -GW0032 Coded/ Replicate No. — Date 8 / 18 / 97

Weather Sunny 90's Purge Begin 1125 Purge Ended 1200 Time Collected 1205

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	± 2	MP Elevation	
Total Sounded Depth of Well Below MP	124.00	Water-Level Elevation	
Depth of Water Below MP	93.45	Diameter of Casing	2"
Water Column in Well	28.55	Total Purge Volume	25
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	4.5680	(feet below MP)	±105

28.55
.16
17130
28550
4.5680

Evacuation Method 2" Sub. Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance Clear Temperature 22/21/22/21 °C

Specific Conductance (mmhos/cm) 0.51/0.52/0.52/0.53 pH 6.86/6.85/6.88/6.80 Dissolved Oxygen 2.6/2.5/2.8/2.4 mg/L

Turbidity >200/11.06/10.10/ NTUs Eh mV 10 Gal/15 Gal/20 Gal/

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-23

Sample I.D. 970818 -LD-23 -GW0023 Coded/ Replicate No. — Date 8 /18 / 97

Weather Sunny 90's Purge Begin 1510 Purge Ended 1645 Time Collected 1655

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ±2.5 MP Elevation

Total Sounded Depth of Well Below MP 81.8 Water-Level Elevation

Depth of Water Below MP 32.05 Diameter of Casing

Water Column in Well 49.75 Total Purge Volume

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 7.960 x 5 = 40 (feet below MP) 80

81.80
32.05
49.75
.16
7.960
8x5

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color LT Yellow Odor — Appearance Turbid Temperature 22/22/23/23C

Specific Conductance (mmhos/cm) 0.17/0.17/0.17/0.17 pH 5.70/5.76/5.84/5.78 Dissolved Oxygen 1.8/1.4/1.6/2.4 mg/L

Turbidity 7200/7200/56/22 NTUs Eh mV 15gal/22gal/25gal/40

Other

CONTAINER DESCRIPTION

Constituents Sampled — From Lab X or G&M — Preservative

Constituents Sampled	Container	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks Well went dry 2 times during purge

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-2d

Sample I.D. 970818 -LD-23 -GW 002d Coded/ Replicate No. MS/MSD Date 8 / 18 / 97

Weather overcast Purge Begin 1740 Purge Ended 1840 Time Collected 1850

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	+2.5	MP Elevation	
Total Sounded Depth of Well Below MP	76.50	Water-Level Elevation	
Depth of Water Below MP	13.04	Diameter of Casing	2"
Water Column in Well	63.46	Total Purge Volume	30
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	10.15 X5 = 50.75	(feet below MP)	75

76.50
13.04
63.46
.16
38076
63460
101536
10.15
50.75

Evacuation Method 2" submersible pump

SAMPLING DATA/FIELD PARAMETERS

Color LT Brown Odor ~ Appearance Turbid Temperature 22/21/21 °C

Specific Conductance (mmhos/cm) 0.31/0.29/0.29 pH 5.49/5.95/5.51 Dissolved Oxygen 1.3/2.3 mg/L

Turbidity >200/>200/>200 NTUs Eh mV 20 gal/25 30/25

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks Pumped dry 3 times

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-25S

Sample I.D. 970819 -LD- 23 -GW0025S Coded/ Replicate No. — Date 8 / 19 / 97

Weather Sunny 80's Purge Begin 1200 Purge Ended 1220 Time Collected 1225

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	48.80	Water-Level Elevation	
Depth of Water Below MP	17.85	Diameter of Casing	2"
Water Column in Well	30.95	Total Purge Volume	
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	4.96 x5=20	(feet below MP)	48

48.80 − 17.85 = 30.95; 31 × .16 = 186 + 310 = 4.96

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 23/22/22 °C

Specific Conductance (mmhos/cm) 0.79/0.77/0.78 pH 7.45/7.55/7.44 Dissolved Oxygen 2.8/1.6/1.5 mg/L

Turbidity 2.5/2.51 NTUs Eh ____ mV 5 gal / 10 gal / 15 gal /

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. TMW-25D

Sample I.D. 970819 -LD-23 -GW0025D Coded/ Replicate No. GUARDIAN SPLIT 970819-LD-23-GW90025D Date 8 / 19 / 97

Weather OVERCAST 70's Purge Begin 920 Purge Ended 1000 Time Collected 1030

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	70.1	Water-Level Elevation	
Depth of Water Below MP	17.15	Diameter of Casing	2"
Water Column in Well	52.95	Total Purge Volume	
Gallons per Foot	8.48x5=42.40	Sampling Pump Intake	
Gallons in Well	0.16	(feet below MP)	68

70.10 17.15 52.95 .16 318 530 8.48 x5 42.40 8.48

Evacuation Method 2" SUBMERSIBLE PUMP

SAMPLING DATA/FIELD PARAMETERS

Color CLEAR Odor – Appearance TURBID Temperature 22/24 °C

Specific Conductance (mmhos/cm) 0.45/1.00 pH 7.95/10.42 Dissolved Oxygen 2.1 mg/L

Turbidity >200/>200 NTUs Eh ____ mV 15GAL/20GAL

Other

CONTAINER DESCRIPTION

Constituents Sampled — From Lab X or G&M ____ — Preservative

VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks 970819-LD-23-FB0002 & 970819-LD-23-EB0002 COLLECTED PRIOR TO PURGE

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-26

Sample I.D. 970820 -LD- 38 -GW0026 Coded/ Replicate No. — Date 8 / 20 / 97

970821-LD-38-GW0026

Weather OVERCAST 70's Purge Begin 920 Purge Ended 930 Time Collected 930

SAMPLE NOT SUBMITTED JH 12/19/97

8/21/97 1750 SAMPLE SUBMITTED JH 12/19/97

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	142	Water-Level Elevation	
Depth of Water Below MP	85.40	Diameter of Casing	2"
Water Column in Well	56.60	Total Purge Volume	5
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	9.1x5 = 46	(feet below MP)	

142.00 − 85.40 = 56.60; 56.6 × .16 = 9.056

Evacuation Method 2" SUBMERSIBLE PUMP

SAMPLING DATA/FIELD PARAMETERS

Color CLEAR Odor SULFUR Appearance SHEEN — Temperature 22 / 20 °C

Specific Conductance (mmhos/cm) 2.91 / 2.85 pH 7.79 / 7.83 Dissolved Oxygen 0.9 / 1.3 mg/L

Turbidity 1.55 / 720 NTUs Eh ______ mV

Other

CONTAINER DESCRIPTION

Constituents Sampled — From Lab X or G&M ____ — Preservative

Constituents Sampled	Container	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks COULD NOT GET ALL BUBBLES OUT OF VOCS DUE TO EFFERVESCENCE CAUSED BY ACID

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 8 of 20

Site Location Birmingham, Alabama Site/Well No. MW-27

Sample I.D. 970819 -LD-38 -GW0027 Coded/ Replicate No. — Date 8 / 19 / 97

Weather Hot 90's Purge Begin 17:20 Purge Ended 17:45 Time Collected 17:50

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ±2.5 FT MP Elevation

Total Sounded Depth of Well Below MP 39.4 Water-Level Elevation

Depth of Water Below MP 16.05 Diameter of Casing 2"

Water Column in Well 23.35 Total Purge Volume

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 3.736 x5 =20 (feet below MP)

39.40
16.05
23.35 3.7360
.16
14010
2335
3.7360

Evacuation Method 2" SUBMERSIBLE PUMP

SAMPLING DATA/FIELD PARAMETERS

Color NONE Odor NONE Appearance Clear Temperature 20 °C

Specific Conductance (mmhos/cm) 0.84 pH 6.56 Dissolved Oxygen 1.8 mg/L

Turbidity 1.97 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-28

Sample I.D. 970819 -LD-38 -GW0028 Coded/ Replicate No. — Date 8 / 19 / 97

Weather Sunny 90's Purge Begin 1415 Purge Ended 1945 Time Collected 1450

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ±2.5 MP Elevation

Total Sounded Depth of Well Below MP 60.50 Water-Level Elevation

Depth of Water Below MP 16.28 Diameter of Casing 2"

Water Column in Well 44.22 Total Purge Volume 40 GAL

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 7.08 x 5 = 35.4 (feet below MP) 50

60.50 − 16.28 = 44.22; 44.22 × .16 = 7.08; 7.08 × 5 = 35.40

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor Sulfur Appearance — Temperature 23 °C

Specific Conductance (mmhos/cm) 0.61 pH 7.23 Dissolved Oxygen 1.9 mg/L

Turbidity 5.1 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-29

Sample I.D. 970819 -LD- 38 -GW 0029 Coded/ Replicate No. —— Date 8 / 19 / 97

Weather Sunny 80's → 90's Purge Begin 1320 Purge Ended 1330 Time Collected 1330

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	30.85	Water-Level Elevation	
Depth of Water Below MP	20.55	Diameter of Casing	2"
Water Column in Well	10.30	Total Purge Volume	10
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	1.65x5=8.25	(feet below MP)	25

30.85 -20.55 10.30 .16 6180 1030 1.6480 1.65 32 8.25 5

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 29 °C

Specific Conductance (mmhos/cm) 0.63 pH 7.34 Dissolved Oxygen .1.1 mg/L

Turbidity 3.6 NTUs Eh ______ mV 10 gal

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M ____	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-30S

Sample I.D. 970821 -LD-38 -GW0030S Coded/ Replicate No. 970821-LD-38-GW0030S MS/MSD Date 8 / 21 / 97

Weather 80's Sunny Purge Begin 1315 Purge Ended 1325 Time Collected 1330

EVACUATION DATA

Description of Measuring Point (MP) TOC ±

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	37.5	Water-Level Elevation	
Depth of Water Below MP	21.10	Diameter of Casing	2"
Water Column in Well	16.40	Total Purge Volume	15
Gallons per Foot	0.16	Sampling Pump Intake (feet below MP)	30
Gallons in Well	2.6 x5 = 13		

16.40
.16
9840
1640
2.6240

2.6
3
7.8

Evacuation Method 2" submersible pump.

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 22 °C

Specific Conductance (mmhos/cm) 0.51 pH 6.60 Dissolved Oxygen 4.4 mg/L

Turbidity 10.1 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-30D

Sample I.D. 970821 -LD-38 -GW0030D Coded/ Replicate No. — Date 8 / 21 / 97

Weather 80's Purge Begin 1415 Purge Ended 1455 Time Collected 1500

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	61.5	Water-Level Elevation	
Depth of Water Below MP	20.65	Diameter of Casing	2"
Water Column in Well	40.85	Total Purge Volume	35
Gallons per Foot	0.16	Sampling Pump Intake (feet below MP)	55
Gallons in Well	6.5 x5 = 32.5		

61.50
20.65
40.85
.16
4510
0850

6.5360
6.5
5
32.5

Evacuation Method 2" submersible pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 21 °C

Specific Conductance (mmhos/cm) 0.55 pH 7.08 Dissolved Oxygen 2.1 mg/L

Turbidity 6.2 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

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Site Location Birmingham, Alabama Site/Well No. MW-31

Sample I.D. 970821 -LD- 39 -GW0031 Coded/ Replicate No. — Date 8 / 21 / 97

Weather Sunny 80's Purge Begin 945 Purge Ended 1025 Time Collected 1030

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	49.27	Water-Level Elevation	
Depth of Water Below MP	20.70	Diameter of Casing	2"
Water Column in Well	28.57	Total Purge Volume	25
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	4.6 x 5 = 23	(feet below MP)	

49.27 20.70 28.57 .16 17142 28570 4.5712 4.6 230

Evacuation Method 2" submersible pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance Turbid Temperature 23 °C

Specific Conductance (mmhos/cm) 0.43 pH ~~7.27~~ 6.64 Dissolved Oxygen 1.9 mg/L

Turbidity 136.4 NTUs Eh ____ mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 14 of 20

Site Location Birmingham, Alabama Site/Well No. MW-32

Sample I.D. 970821 -LD-39 -GW 0032 Coded/ Replicate No. — Date 8 / 21 / 97

Weather Sunny 80's Purge Begin 1105 Purge Ended 1140 Time Collected 1145

EVACUATION DATA

Description of Measuring Point (MP) Toc

Height of MP Above/Below Land Surface	+2.5	MP Elevation	
Total Sounded Depth of Well Below MP	49.9	Water-Level Elevation	
Depth of Water Below MP	16.80	Diameter of Casing	2"
Water Column in Well	33.10	Total Purge Volume	30
Gallons per Foot	0.16	Sampling Pump Intake (feet below MP)	25
Gallons in Well	5.3×5 = 26.5		

33.10
.16
19860
33100
5.2960
5.3
5
26.5

Evacuation Method

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance Clear Temperature 24 °C

Specific Conductance (mmhos/cm) 0.45 pH 6.63 Dissolved Oxygen 3.7 mg/L

Turbidity 9.2 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 15 of 20

Site Location Birmingham, Alabama Site/Well No. MW-33

Sample I.D. 970820 -LD- 39 -GW0037 Coded/ Replicate No. Date 8 / 20 / 97

Weather Sunny 80's Purge Begin 1650 Purge Ended 1715 Time Collected 1720

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ±2.5 MP Elevation

Total Sounded Depth of Well Below MP 41.40 Water-Level Elevation

Depth of Water Below MP 8.15 Diameter of Casing 2"

Water Column in Well 33.25 Total Purge Volume 30

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 5.33 X5 = 27 Gal (feet below MP) 15

41.40
8.15
33.25
.16
5.3300
5
26.65

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 22 °C

Specific Conductance (mmhos/cm) 1.14 pH 6.40 Dissolved Oxygen 2.8 mg/L

Turbidity 0.80 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

proj\tf320\wslog1.xls

GERAGHTY & MILLER, INC.
Environmental Services
A Heidemij Company

WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 16 of 20

Site Location Birmingham, Alabama Site/Well No. MW-34S

Sample I.D. 970820 -LD- 39 -GW0034S Coded/ Replicate No. GUARDIAN SPLIT 970820-LD-39-GW9034S Date 8 / 20/ 97

Weather Overcast 80's occasional light rain Purge Begin 1200 Purge Ended 1225 Time Collected 1230

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	36.4	Water-Level Elevation	
Depth of Water Below MP	6.35	Diameter of Casing	2"
Water Column in Well	30.05	Total Purge Volume	25
Gallons per Foot	0.16	Sampling Pump Intake	
Gallons in Well	4.8 x 5 = 23	(feet below MP)	

36.40
6.35
30.05
.16
18030
30050
4.8080

4.8
5
23.0

Evacuation Method 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance — Temperature 21 °C

Specific Conductance (mmhos/cm) 1.49 pH 6.55 Dissolved Oxygen 1.3 mg/L

Turbidity 8.85 NTUs Eh mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks 970820-LD-39-FB0004 & 970820-LD-39-EB0004, 970820-LD-39-FB0005 & 970820-LD-39-EB0005 Guardian

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

GERAGHTY & MILLER, INC.
Environmental Services
A Heidemij Company

WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 17 of 20

Site Location Birmingham, Alabama Site/Well No. MW-34D

Sample I.D. 9708 24 -LD- 39 -GW00 34D Coded/ Replicate No. — Date 8 / 24 / 97

Weather Purged & Sampled over 2 days Purge Begin 8/20/97 1400 Purge Ended — Time Collected 1715

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ± 2.5 MP Elevation

Total Sounded Depth of Well Below MP 182 Water-Level Elevation

Depth of Water Below MP 5.65 Diameter of Casing 2"

Water Column in Well 174.35 Total Purge Volume 32

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 27.9 x 5 = 140 (feet below MP)

182.00 5.65 174.35 .16 10460 17435 27896 28 5 140

Evacuation Method 2" submersible pump

SAMPLING DATA/FIELD PARAMETERS

Color Clear Odor — Appearance Sturbid Temperature 22 / 23 °C

Specific Conductance (umhos/cm) 1.15 | 1.16 pH 9.28 | 8.47 Dissolved Oxygen 1.0 | 2.2 mg/L

Turbidity 5.2 | >200 NTUs Eh mV 30gal | 32

Other

DTW 30gal 176.1

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

proj\tf320\wslog1.xls

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A Heidemij Company

WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 18 of 20

Site Location Birmingham, Alabama Site/Well No. MW-35

Sample I.D. 970821 -LD- 39 -GW0035 Coded/ Replicate No. — Date 8 / 21 / 97

Weather 80's Purge Begin NA Purge Ended NA Time Collected 1530

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP		Water-Level Elevation	
Depth of Water Below MP		Diameter of Casing	
Water Column in Well		Total Purge Volume	
Gallons per Foot		Sampling Pump Intake	
Gallons in Well		(feet below MP)	

Evacuation Method BAILED DRY 5 TIMES ALLOWED TO RECHARGE FROM 8/20/97

SAMPLING DATA/FIELD PARAMETERS

Color CLEAR Odor — Appearance — Temperature 22 °C

Specific Conductance (~~u~~mmhos/cm) 1.69 pH 7.47 Dissolved Oxygen 6.0 mg/L

Turbidity 5.7 NTUs Eh ______ mV

Other

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M ___	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

GERAGHTY & MILLER, INC.
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WATER SAMPLING LOG

Project Name/Number Sloss Industries / TF0320.015 Page 19 of 20

Site Location Birmingham, Alabama Site/Well No. MW-36

Sample I.D. 970821 -LD- 39 -GW0036 Coded/ Replicate No. — Date 8 / 21 / 97

Weather PURGED & SAMPLED OVER 2 DAYS Purge Begin 900 8/20/97 Purge Ended 1225 Time Collected 1240

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ±2.5 MP Elevation

Total Sounded Depth of Well Below MP 139 Water-Level Elevation

Depth of Water Below MP 0 Diameter of Casing 2"

Water Column in Well 139 Total Purge Volume 75

Gallons per Foot 0.16 Sampling Pump Intake

Gallons in Well 22.24 x 5 = 112 (feet below MP)

139 × .16 = 834 / 139 = 22.24; 22.24 × 5 = 111.20

Evacuation Method NATURAL PURGE - ARTESIAN WELL

SAMPLING DATA/FIELD PARAMETERS

Color CLEAR Odor SULFUR Appearance — Temperature 22 / 22 / 22 °C

Specific Conductance (mmhos/cm) 0.99 / 1.01 / 1.01 pH 9.17 / 9.15 / 9.16 Dissolved Oxygen 1.7 / 1.6 / 1.2 mg/L

Turbidity 3.2 / 1.5 / 2.4 NTUs Eh ______ mV 20 GAL / 30 GAL

Other

CONTAINER DESCRIPTION

Constituents Sampled — From Lab X or G&M — Preservative

Constituents Sampled	Container	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks

Sampling Personnel Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

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WATER SAMPLING LOG

Project Name/Number: Sloss Industries / TF0320.015 Page 20 of 20

Site Location: Birmingham, Alabama Site/Well No. MW-37

Sample I.D.: 970821 -LD- 38 -GW 0037 Coded/Replicate No. — Date 8 / 21 / 97

Weather: 80's Purge Begin 850 Purge Ended 905 Time Collected 910

EVACUATION DATA

Description of Measuring Point (MP): TOC

Height of MP Above/Below Land Surface	±2.5	MP Elevation	
Total Sounded Depth of Well Below MP	30.20	Water-Level Elevation	
Depth of Water Below MP	3.80	Diameter of Casing	2"
Water Column in Well	26.40	Total Purge Volume	22
Gallons per Foot	0.16	Sampling Pump Intake (feet below MP)	
Gallons in Well	4.2 x5=21.0		

30.20 − 3.80 = 26.40; 26.40 × .16 = 4.2240 ≈ 4.2; 4.2 × 5 = 21.0

Evacuation Method: 2" Submersible Pump

SAMPLING DATA/FIELD PARAMETERS

Color: Clear Odor: — Appearance: — Temperature: 26 °C

Specific Conductance (mmhos/cm): .51 pH: 6.97 Dissolved Oxygen: 1.5 mg/L

Turbidity: 4.7 NTUs Eh: ____ mV

Other:

CONTAINER DESCRIPTION

Constituents Sampled	From Lab X or G&M	Preservative
VOCs (8260)	3 40-ml vials	HCL
SVOCs (8270)	2 1-liter amber glass	None
Cyanide (9010)	1 1-quart, plastic	NaOH
Priority Pollutant Metals & Barium (6010)	500 ml plastic	HNO3
Mercury (7470)	500 ml glass	HNO3

Remarks:

Sampling Personnel: Joe Hughes, David Page

WELL CASING VOLUMES

GAL./FT.				
	1-1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.09	2-1/2" = 0.26	3-1/2" = 0.50	6" = 1.47

VOLUME I

APPENDIX B

GEOPHYSICAL INVESTIGATION REPORT

GEOPHYSICAL SURVEY AT SLOSS INDUSTRIES
BIRMINGHAM, ALABAMA

August 1997

Prepared for

Prepared by

Geraghty & Miller, Inc.
Environmental & Infrastructure
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(303) 294-1200

ARCADIS GERAGHTY & MILLER

CONTENTS

FIGURES

GEOPHYSICAL SURVEY AT SLOSS INDUSTRIES BIRMINGHAM, ALABAMA

INTRODUCTION

Geophysical surveys were required around Solid Waste Management Units (SWMU) at SLOSS Industries facility in Birmingham, Alabama. These surveys satisfy some of the requirements of an RIFS at this site. The surveys were a continuation of earlier surveys conducted in 1996, when seismic refraction data was recorded around the SWMU's.

The data was recorded during the time period July 7 to July 14, 1997.

Conductivity and resistivity surveys were run round SWMU 23 and SWMU 38/39. These were designed to see if conductive landfill material had migrated away from the landfills, probably as a leachate moving in the groundwater under and around the landfills.

GEOLOGY / PHYSICS

Many contaminants increase the electrical conductivity of water. This occurs either because the contaminant itself is electrically conductive, or more commonly because a suite of fluids moves with the contaminant, components of which are electrically conductive. Probably the most common substances which increase the electrical conductivity of water are salts of various kinds. When these flow from the ground surface through the unsaturated zone to the saturated zone they first increase the conductivity of the unsaturated zone. Once they reach the groundwater they then increase its electrical conductivity.

The electrical conductivity of soils and rocks depends mostly on the porosity of these materials, the conductivity of the saturating water and the degree of saturation of the pores. However, another factor to be considered is the amount of clay present. Clays are very fine grained material and often have free electrical charges on the grain surfaces. These charges contribute to the electrical conductivity and result in the conductivity of clay materials being higher than can be accounted for by considering porosity and saturating water conductivity.

At the Sloss site five to twenty feet of soil covers a limestone bedrock. The limestone is steeply dipping and forms a somewhat erratic bedrock surface. In situ weathering of the bedrock has resulted in the formation of lenses of clay.

Geophysical surveys were conducted around two main Solid Waste Management Units (SWMU) at the site. These landfills contain industrial waste including fly ash which contains metals. It is suspected that this material may be electrically conductive. The geophysical surveys were designed to measure the electrical conductivity of the ground and to locate any anomalous areas of unusually high conductivity.

It is expected that the electrical conductivity of the ground at Sloss can be broadly divided into the overburden conductivity and the bedrock conductivity. Although the water table is generally well below the bedrock surface there are areas of saturation within the limestone above the water table. It is expected that the limestone bedrock will generally have a lower conductivity than the overburden. This is because, apart from fractured regions, limestone is generally a low porosity rock. In regions where the limestone is fractured and saturated its conductivity will be increased. Contamination from the SWMU 's, if it occurs, may have drained vertically into the ground until reaching a saturated zone within the limestone. It would then move along with the groundwater movement, which is generally to the north. In addition, during heavy rains, contamination may drain from the SWMU's onto the local ground surface and then infiltrate the soil and bedrock. The geophysical surveys are primarily designed to locate areas of high conductivity associated with contaminants in the bedrock.

Because of the higher expected conductivity of the overburden, and the variable nature of the overburden thickness, surveys were performed to map the ground conductivity to different depths. This better allows an interpretation of the conductivity of the overburden and the bedrock.

GEOPHYSICAL MEASUREMENTS

The electrical conductivity of the ground can be measured using several different methods. Two methods were used on this survey broadly called Terrain Conductivity and Ground Resistivity. Terrain Conductivity was measured using two instruments, one called an EM31 and the other an EM34. The EM31 can measure Terrain Conductivity at two depths, 10 and about 18 feet. At this site the EM31 was used to measure conductivities to 18 feet depth. The EM34 can also be used in different modes to give different depths. At this site the instrument was used with a coil separation of 20 meters and in the horizontal dipole mode. In this configuration the instrument has a depth of investigation of about 50 feet. Both instruments essentially measure the bulk electrical conductivity of the ground down to the depth of investigation of that instrument.

In addition, Ground Resistivity measurements were also taken. These measure the resistivity (reciprocal of conductivity) of the ground. Ground Resistivity measurements were taken using four electrodes (12 inch nails) placed into the ground a few inches. The electrodes are in a straight line with the two inner electrodes being placed close together (a few feet) and the two outer electrodes being either 20 feet or 100 feet from the center of the "array". This particular electrode array used to obtain the resistivity measurements is called the Schlumberger array. A small electrical current is passed through the outer electrodes which then penetrates the ground. The voltage developed by this current is then measured across the two inner electrodes. Simple calculations using the electrode array geometry along with the current and measured voltage give the resistivity of the ground. The depth of investigation of the Schlumberger array depends on the resistivity structure of the ground but is generally somewhat less than the distance from the center of the electrode array to one of the outer electrodes.

The EM31 and EM34 instruments use electromagnetic waves to measure the conductivity of the ground. These waves are generated in a coil through which oscillating electrical current flows. The electromagnetic field surrounds the coil and interacts with any conductive material in the vicinity of the coil. At the Sloss site there were above ground pipes at some locations and railroad lines and cars along the north western side of SWMU 38/39. It was suspected that these cars in particular would influence the conductivity readings. This would be particularly true with the EM34 system which penetrates to a greater depth than the EM31 and has a larger sphere of influence. However, with Grounded Resistivity measurements the electrical current is injected directly into the ground. Very little electrical current is present in the atmosphere above the ground and the above ground railroad cars have little influence on the data.

GEOPHYSICAL RESULTS

SWMU 23

SWMU 23 is at the north end of the Sloss site and is at a higher elevation than SWMU 38/39. No "cultural" features are close to the landfill which would interfere with the EM31 or EM34 instruments. Data was recorded with the EM31 at stations spaced 5 feet apart around the landfill. Additionally, data was recorded with the EM34 configured to have a depth of investigation of about 50 feet. EM34 readings were taken every 25 feet. The EM31 data is presented on figure 1. The EM34 data is presented on figure 2. Both of these plots show the conductivity data presented as a colored ribbon around the path taken during data recording. The numbers along this path are the field flag numbers used to locate the traverse. These have been surveyed and are used to locate and present the data at its proper location. These flags are 50 feet apart. The color bar at the side of the data shows the conductivity values associated with each of the traverses. Both the EM31 and EM34 data sets are also presented on Figure 3 in order to compare directly the deep and shallow data. On the EM31 data three anomalies are seen and are labeled A, B and C on figure 1. Figure 2 shows anomalies A and D seen by the deeper looking EM34. Figure 3 shows that anomaly A is clearly observed on both data sets. Anomalies C (EM31) and D(EM34) are each quite complex anomalies and generally occur over the same region but with different locations for their maximum values.

Anomaly B is seen mostly on the EM31 data. The EM34 data shows only a low amplitude anomaly at this site. Therefore this anomaly probably reflects overburden thickness variations rather than conductive material in the bedrock. The region about anomaly A is topographically higher than the SWMU, which appears to be in a small depression in the hillside. Since Anomaly A is visible in the shallow data (EM31), and, because it is topographically higher than the SWMU, it is unlikely to result from contamination from the SWMU. It seems likely therefore that this higher conductivity zone is caused by clay.

As discussed above, anomalies C and D are essentially complex anomalies in the same region and are therefore considered as one anomaly. Thus the area has increased conductivity both at shallow and deeper levels. This area is generally a small valley and is topographically lower than the SWMU. It is possible that these anomalies result from liquids flowing down the valley from the SWMU and infiltrating into the bedrock. However, it should be noted that the maximum conductivity at this location is only about 30 millimho/m which is not a high value. Moreover, the average shallow conductivity is less than 20 millimho/m and the average deep conductivity is less than 15 millimho/m.

SWMU 38/39

It was initially planned to conduct EM31 and EM34 around most of this landfill Resistivity was planned for only a small section along the north western side of the landfill near the rail road tracks. However an overhead pipeline was present along the south eastern part of the SWMU and a buried gas pipeline was present along the northern part of the south eastern side of the landfill. The approximate locations of these pipelines are shown on figures 1 and 2. Because of the overhead pipeline and the railroad tracks and cars it was decided to conduct Grounded Resistivity readings around the landfill instead of the EM34 measurements. Since the radius of influence of the EM31 is only about 20 feet it was felt that the overhead pipeline would not significantly interfere with this data. Only the railroad cars may be a problem for the EM31. Because of this a shallower Grounded Resistivity survey was also conducted along the railroad tracks.

In order to determine the vertical succession of resistivity two Schlumberger soundings were conducted. The locations for the two soundings are shown on figures 1 and 2 as locations S1 and S2. The sounding data is presented as figures 6 and 7. The data is presented as a graph showing the measured resistivity (usually called Apparent resistivity) against the half current electrode spacing. This data has been interpreted to provide the variation of resistivity with depth. The interpretation of each sounding is presented on the upper right hand side of each sounding plot.

Sounding S1 shows a resistive layer, interpreted to be limestone bedrock, at a depth of 9.5 feet. The overburden is more conductive than the bedrock as was expected. Soundings S2 shows bedrock to be somewhat deeper at 21 feet. The limestone bedrock here is less conductive than that at S1 indicating a more competent and less fractured rock. The soundings also show that an electrode spacing of 100 feet penetrates well into the bedrock. A spacing of 20 feet barely reaches the bedrock and provides data mostly influenced by the overburden.

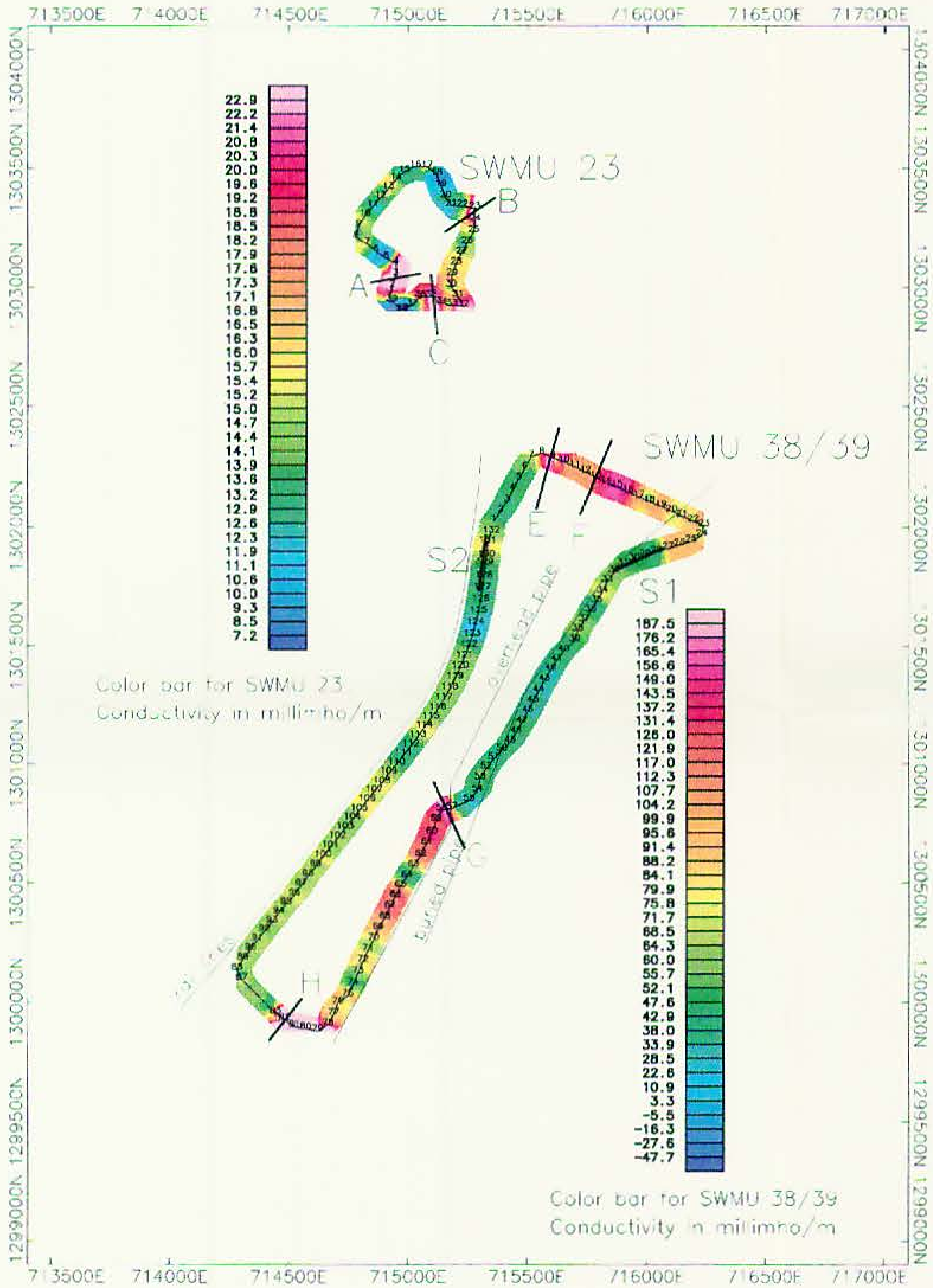
The EM31 data around SWMU 38/39 is presented on figure 1. The resistivity data around SWMU 38/39 is presented on figure 2. Figure 2 shows the resistivity data around the landfill as a colored ribbon representing the conductivity values obtained. The field flag numbers are also presented. Figure 4 presents both the resistivity and EM31 data. The EM31 data shows four areas of higher conductivity. These are shown on figure 1 and are labeled E, F, G and H. The resistivity data, shown on figure 2, shows only anomalies E, F and H. A comparison of the resistivity and EM31 data on figure 4 shows that anomaly G is not seen on the resistivity plot indicating no bedrock anomaly. Thus only anomalies E, F and

H are considered. Anomaly H crosses an area where material from the landfill appears to have spread out and may lie under the traverse location. If this landfill material is conductive, as is suspected, then this anomaly results from this conductive material. This interpretation is supported by the fact that only a low amplitude anomaly seen on the deeper resistivity data at this location. Anomalies E and F are essentially part of a broader region of higher conductivity along the northern edge of the landfill. This is along a roadside. Comparing the EM31 and resistivity data on figure 4 shows that the anomaly is most prevalent on the EM31 data and less so on the resistivity data. Therefore the conductivity anomaly is less pronounced at depth. It is possible that this anomaly results from a clay layer or thicker overburden at this location.

Along the north western side of SWMU 38/39 run several rail road tracks on which were parked a line of rail road cars. It was thought that these cars would influence the EM31 data. If this was the case then the shallow conductivity data along this side of the landfill would not provide a good indication of the overburden conductivity. Therefore a resistivity traverse was conducted along this side of the SWMU using a 20 foot electrode spacing. This electrode spacing provides a similar depth of investigation to that of the EM31. The data is plotted as a colored ribbon on figure 2, offset 100 feet to the west of its correct position. Figure 5 presents this data, converted to conductivity, along with the conductivity data recorded with an electrode spacing of 100 feet. As can be seen from this graph, variations in the shallow conductivity are between 20 and 50 millimho/m which is not a particularly wide range. In addition, no particular anomaly stands out. The deeper conductivity values show even less variation and again present no large anomalies.

CONCLUSIONS

Terrain Conductivity and Ground Resistivity data have been acquired around SWMU 23 and SWMU 38/39 at the Sloss site in Birmingham, Alabama. The surveys show several anomalies labeled A through H. However, anomalies B, G and H all appear to be caused by fairly shallow features and are not considered bedrock anomalies. Anomaly A on SWMU 23 is topographically higher than the SWMU and therefore it seems unlikely that it results from contamination from the SWMU. This anomaly is interpreted as resulting from clay at this location. Anomalies E and F are part of a broad complex anomaly at the north end of SWMU 38/39. Although fairly high conductivity values are seen on the EM31 data much lower values occur on the resistivity data. This anomaly could therefore result from clay or deeper overburden. Finally anomalies C and D (SWMU 23) are part of a complex anomaly at this location. The anomaly is seen in the shallow and deep results although the amplitudes are not particularly high. This data suggests that conductivity is increased in the bedrock at this location.



EM31 Conductivity Data

EM31 data recorded around SWMU 23 and 38/39. Data recorded in vertical dipole mode with readings taken every 5 feet. EM31 boom kept parallel to direction of travel.

Field flags placed around each SWMU. Consecutive flags are 50 feet apart.

EM31 data points around each SWMU.

12 Field flags. These are placed around each SWMU. Consecutive field flags are 50 feet apart.

B Anomalies

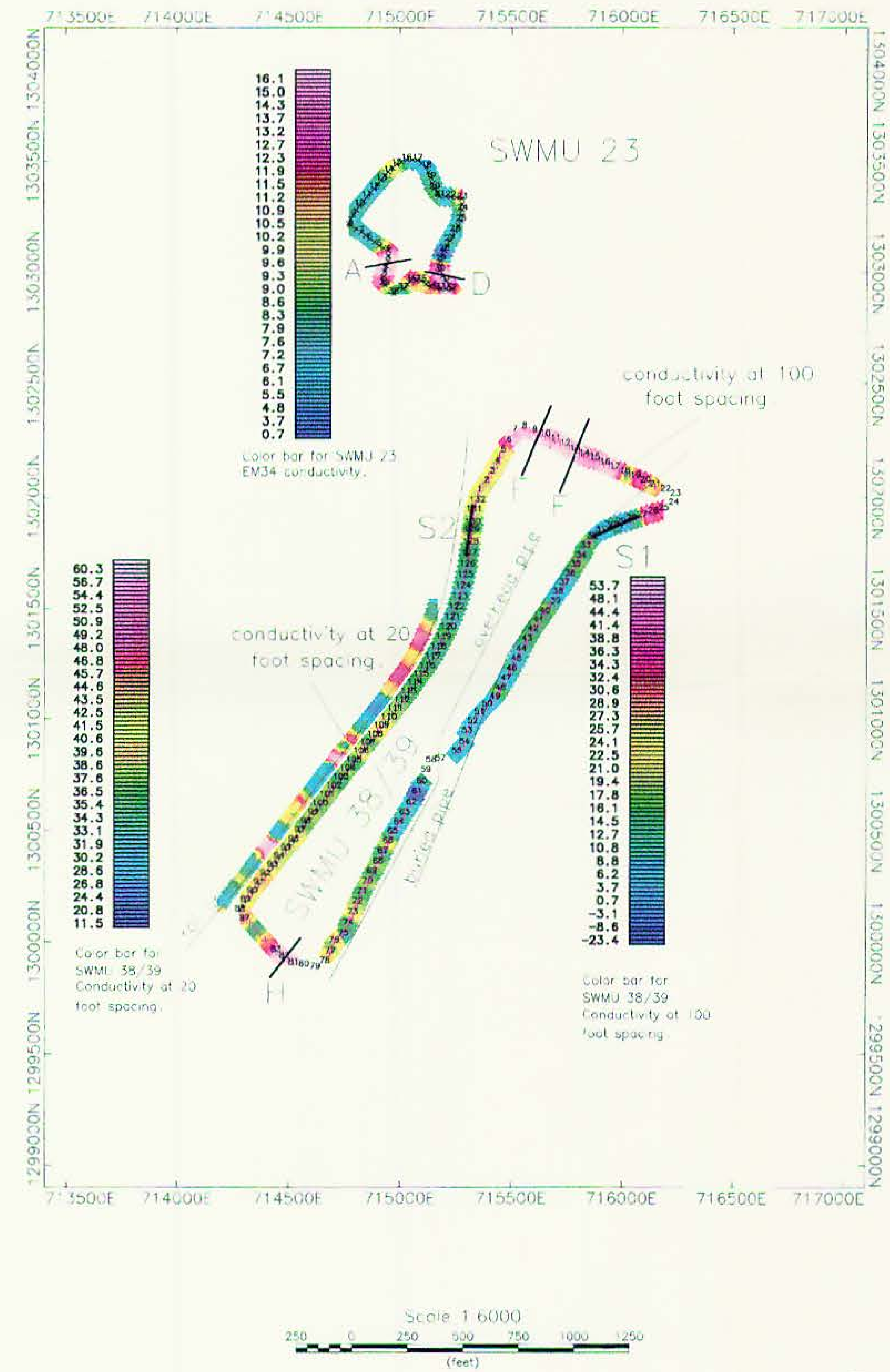
Scale 1:6000

250 0 250 500 750 1000 1250 (feet)

N

FIGURE 1

SLOSS INDUSTRIES CORPORATION
Conductivity and Resistivity Surveys Site at Birmingham, Alabama
EM31 conductivity data, SWMU 23 and 38/39
Geraghty & Miller, Inc. Geophysics Group



EM34 and Resistivity Data

EM34 conductivity data for SWMU 23 is plotted along with Resistivity data for SWMU 38/39.

In order to maintain consistency of the data units, the resistivity data has been converted to conductivity values. Conductivity is the reciprocal of resistivity. On the plot region of this map, all data is referred to as conductivity data.

Resistivity data for SWMU 38/39 was recorded at two electrode spacings. Data at 100 foot spacing was recorded all around the landfills. Data at 20 foot spacing was recorded only along the north western border of the landfill. The resistivity values at 20 foot spacing are shown offset 100 feet to the west of their proper location.

+ Data point. Resistivity, 20 ft. spacing

* Data point. Resistivity, 100 ft. spacing.

× EM34 data point.

12 Field flags. These are placed around each SWMU. Consecutive field flags are 50 feet apart.

—— B Anomalies

S1 Schlumberger sounding

FIGURE 2

SLOSS INDUSTRIES CORPORATION
Conductivity and Resistivity Surveys Site at Birmingham, Alabama
EM34 and Resistivity Data, SWMU 23 and 38/39.
Geraghty & Miller, Inc. Geophysics Group

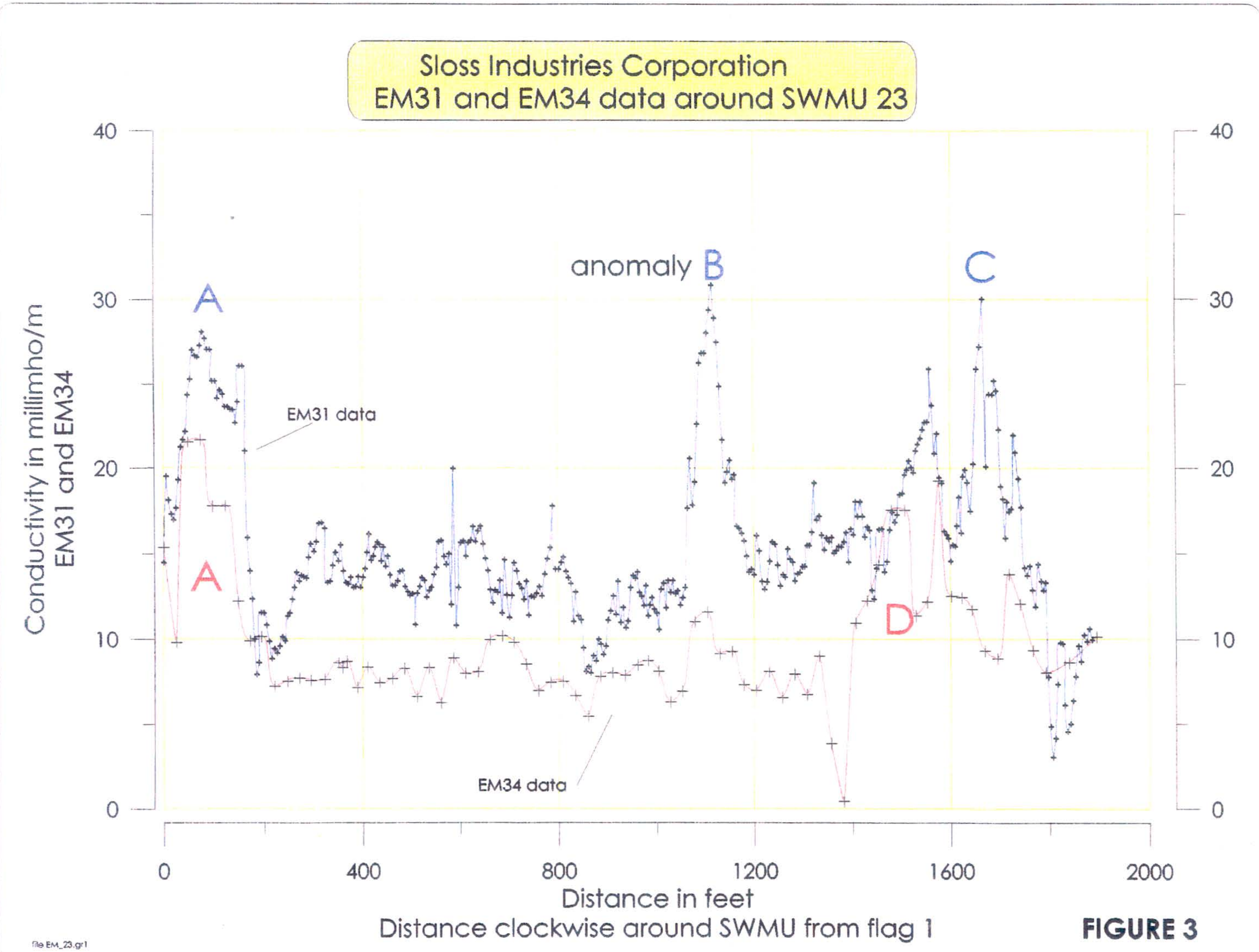
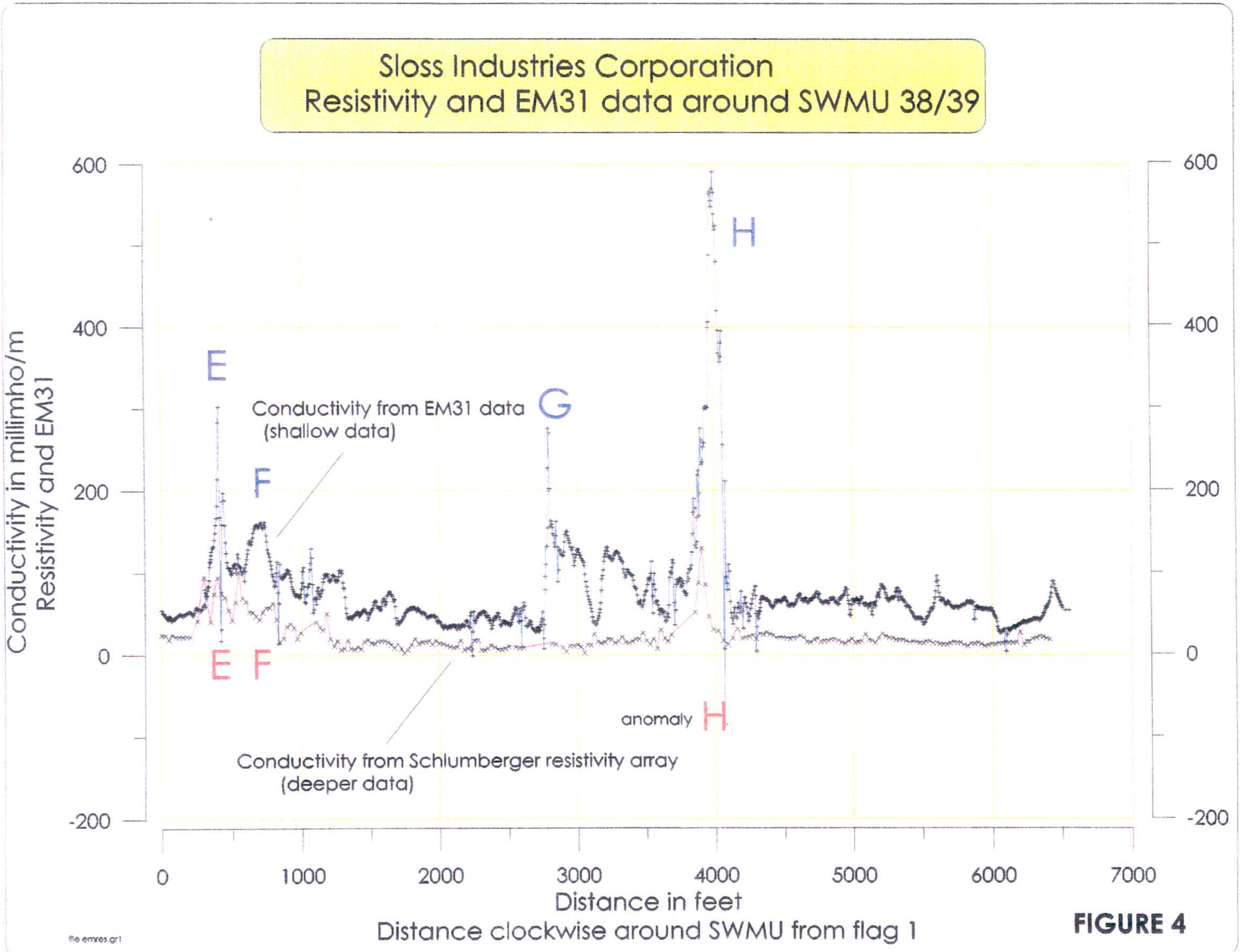
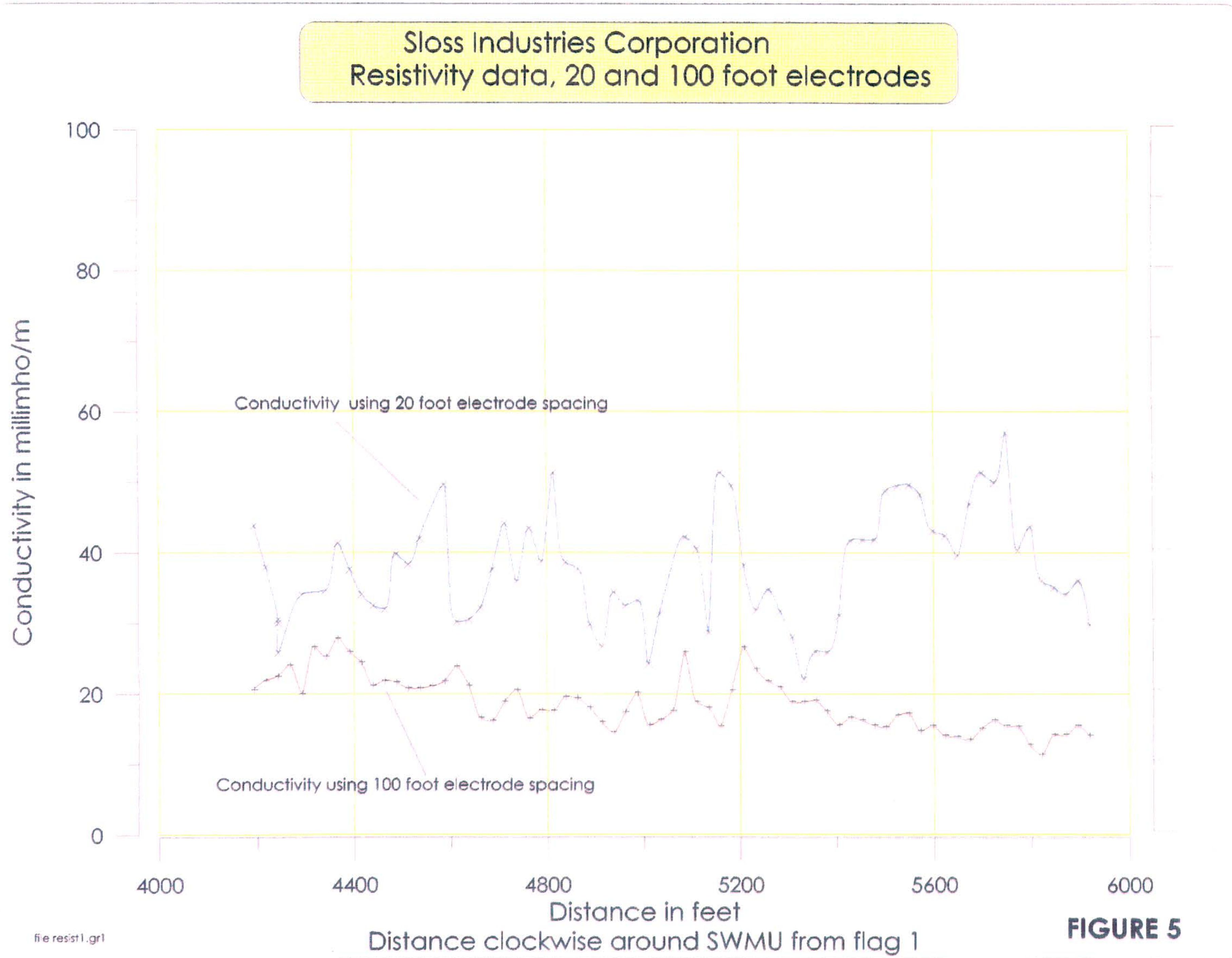

Sloss Industries Corporation
EM31 and EM34 data around SWMU 23
Conductivity in millimho/m
EM31 and EM34
Distance in feet
Distance clockwise around SWMU from flag 1
anomaly B
A
A
C
D
EM31 data
EM34 data
0
10
20
30
40
0
400
800
1200
1600
2000
file EM_23.grf

FIGURE 3



Sloss Industries Corporation
Resistivity and EM31 data around SWMU 38/39
Conductivity in millimho/m
Resistivity and EM31
600
400
200
0
-200
E
F
G
H
E F
anomaly H
Conductivity from EM31 data
(shallow data)
Conductivity from Schlumberger resistivity array
(deeper data)
0
1000
2000
3000
4000
5000
6000
7000
Distance in feet
Distance clockwise around SWMU from flag 1
file emres.grf

FIGURE 4



Sloss Industries Corporation
Resistivity data, 20 and 100 foot electrodes
Conductivity in millimho/m
100
80
60
40
20
0
Conductivity using 20 foot electrode spacing
Conductivity using 100 foot electrode spacing
4000
4400
4800
5200
5600
6000
Distance in feet
Distance clockwise around SWMU from flag 1
file resist1.grf

FIGURE 5

SCHLUMBERGER SOUNDING

Recorded at field flag 28, SWMU 38/39

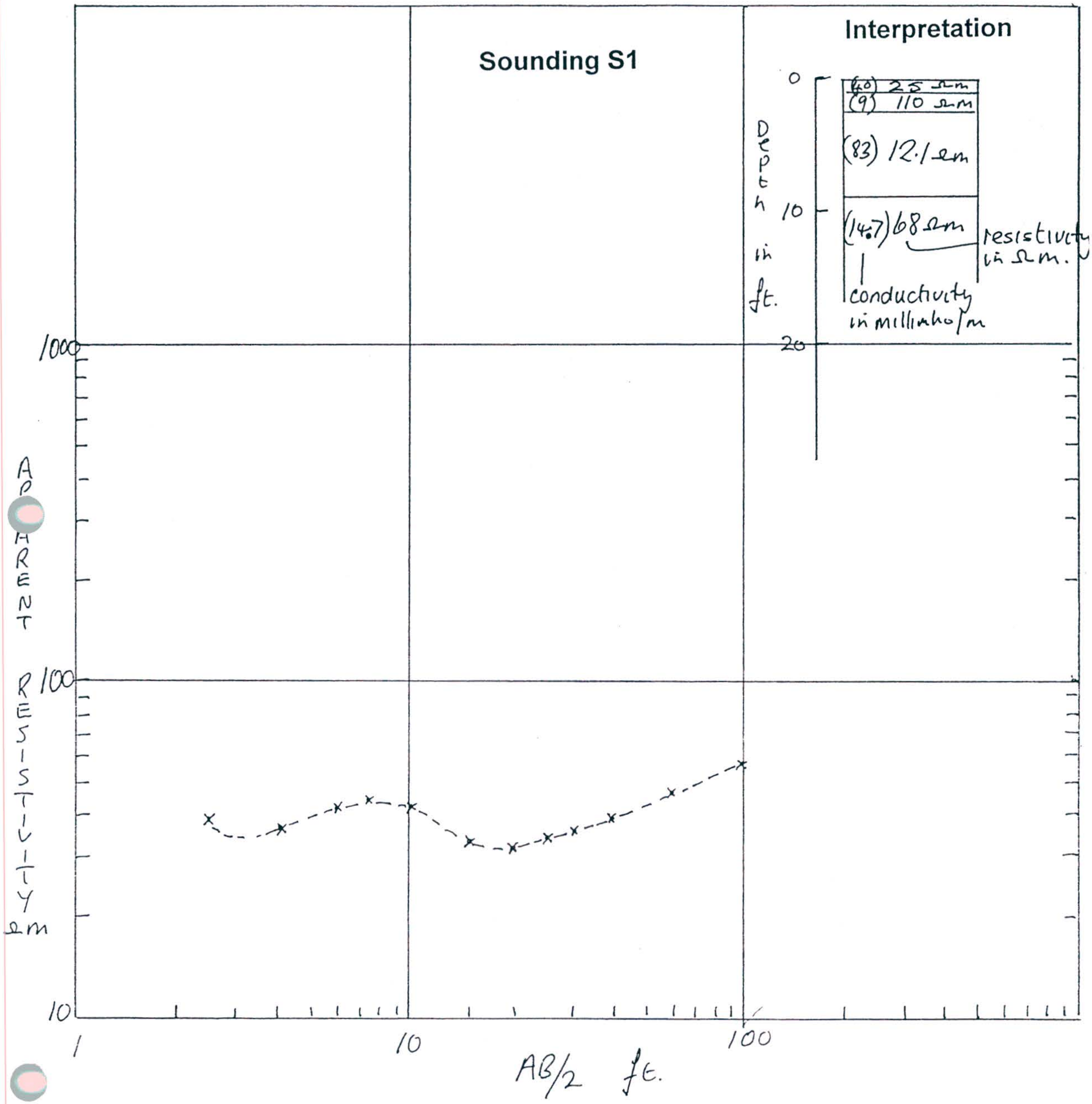


Figure 6

SCHLUMBERGER SOUNDING

Recorded at field flag 127, SWMU 38/39

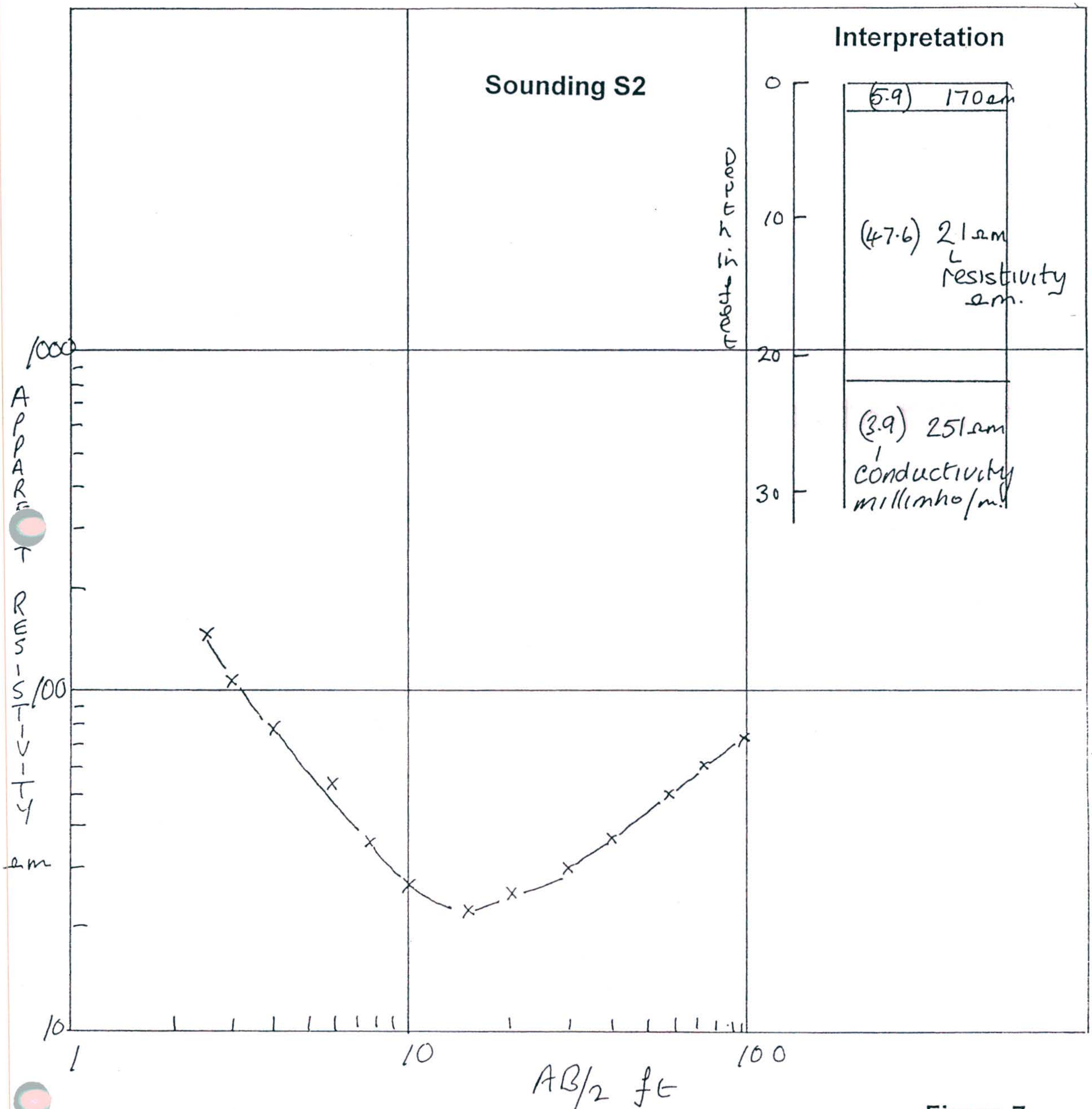
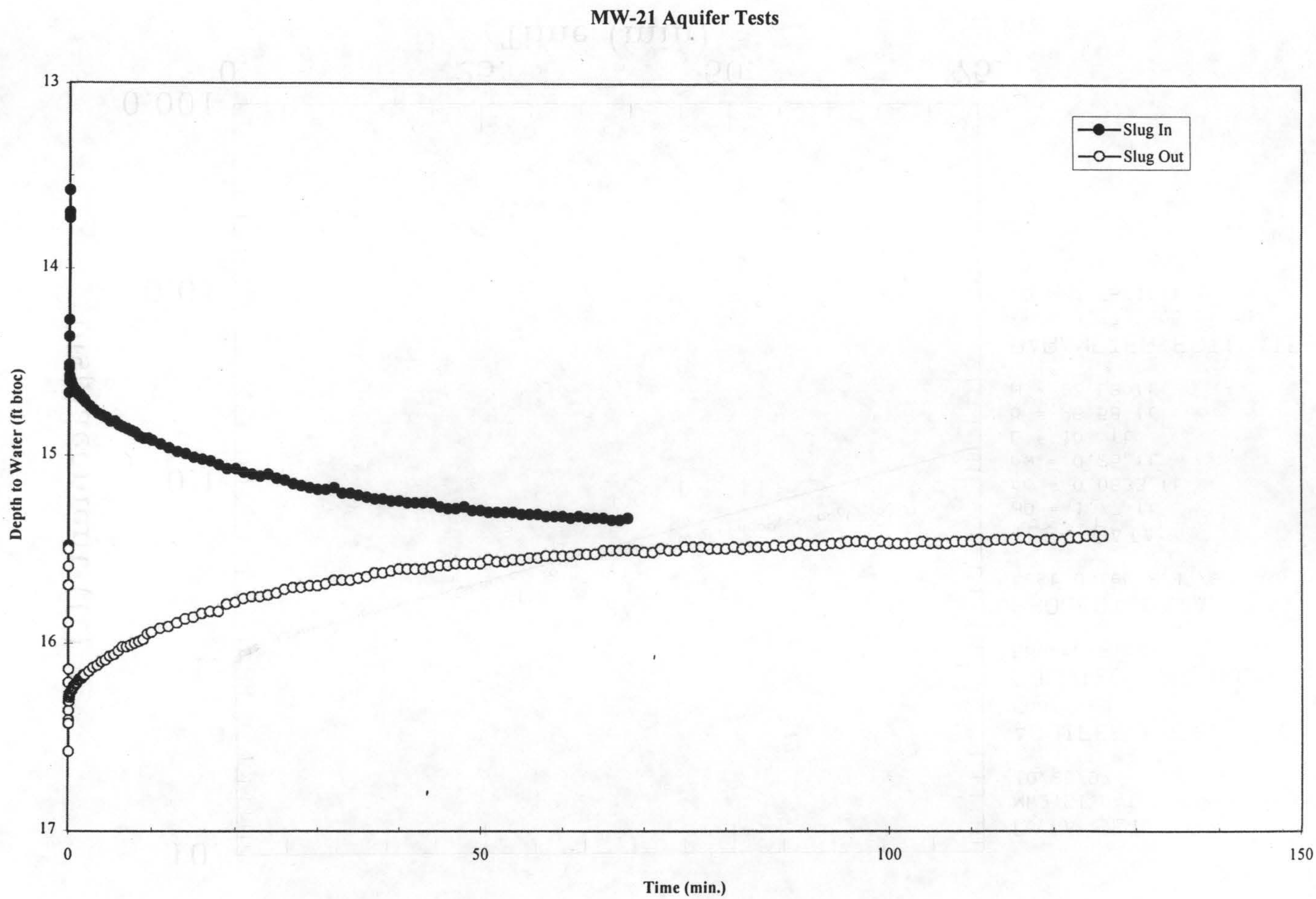


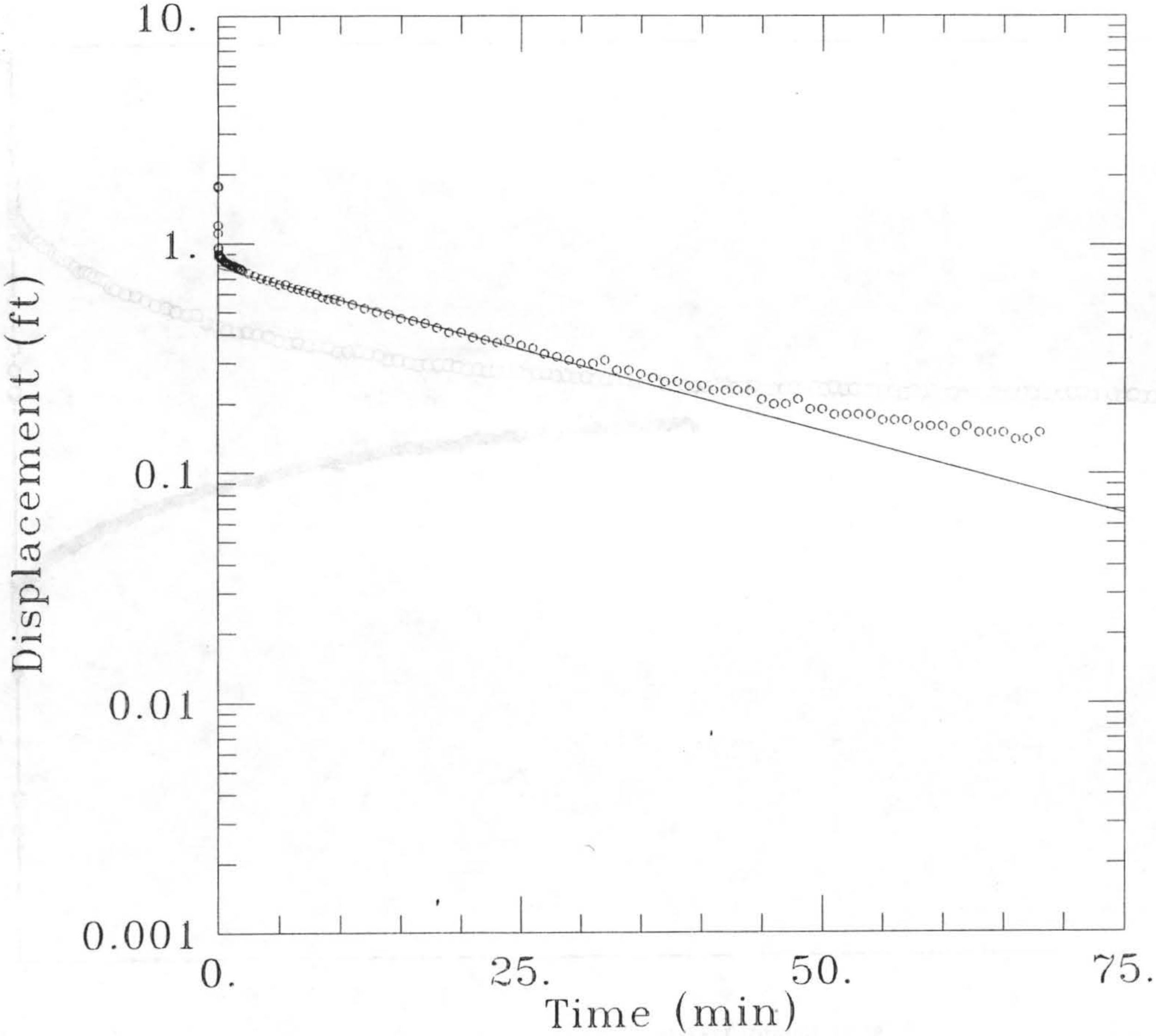
Figure 7

VOLUME I

APPENDIX C

IN-SITU PERMEABILITY TESTING DATA


MW-21 Aquifer Tests
Slug In
Slug Out
Depth to Water (ft btoc)
Time (min.)
13
14
15
16
17
0
50
100
150



DATA SET:
MW21SI.DAT
10/23/97

AQUIFER MODEL:
Confined

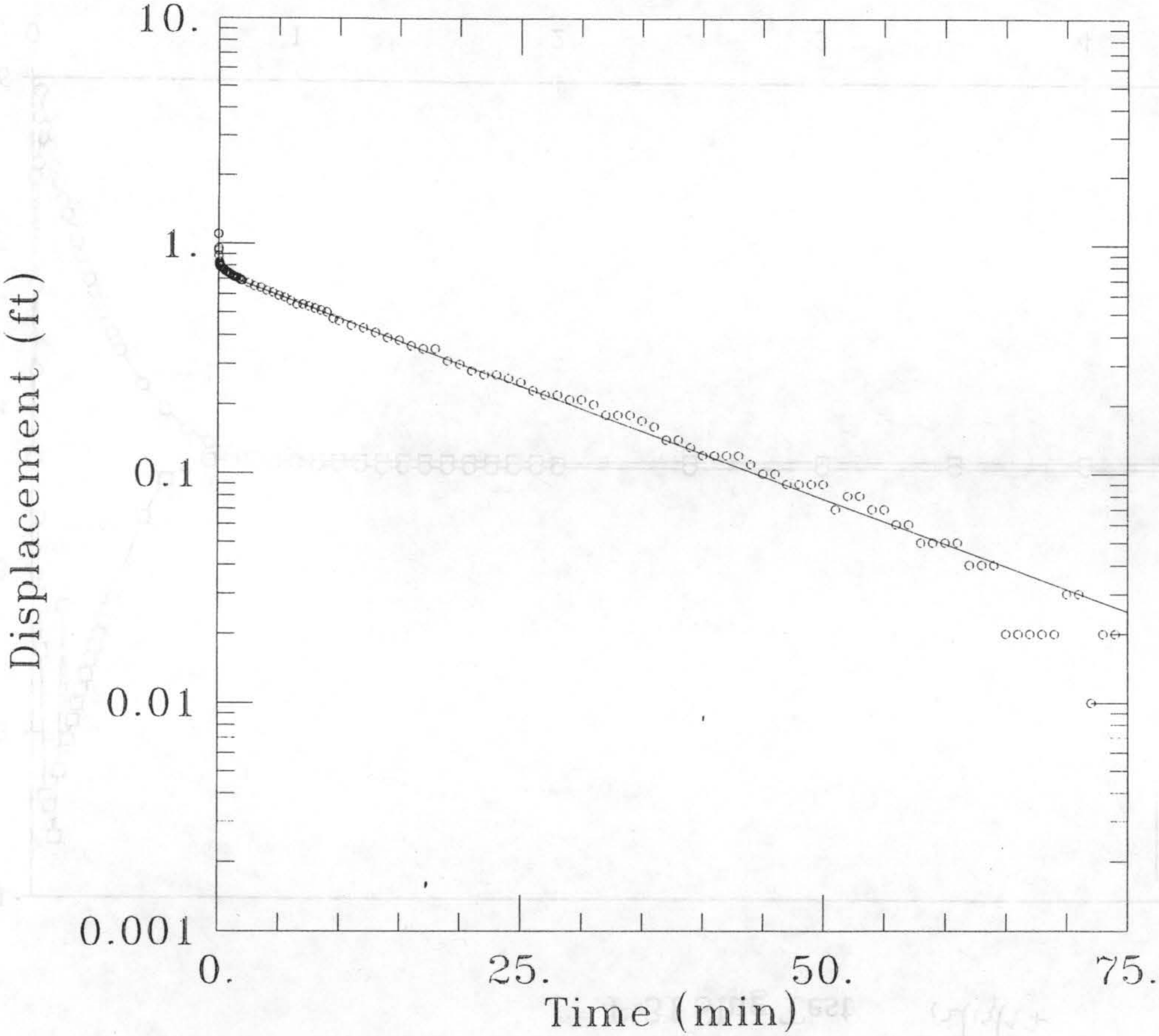
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/17/97

TEST DATA:
H0 = 1.77 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 26.58 ft
H = 26.58 ft

PARAMETER ESTIMATES:
K = 3.873E-05 ft/min
y0 = 0.7841 ft

AQTESOLV



DATA SET:
MW21SO.DAT
10/23/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/17/97

TEST DATA:
H0 = 1.1 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 26.58 ft
H = 26.58 ft

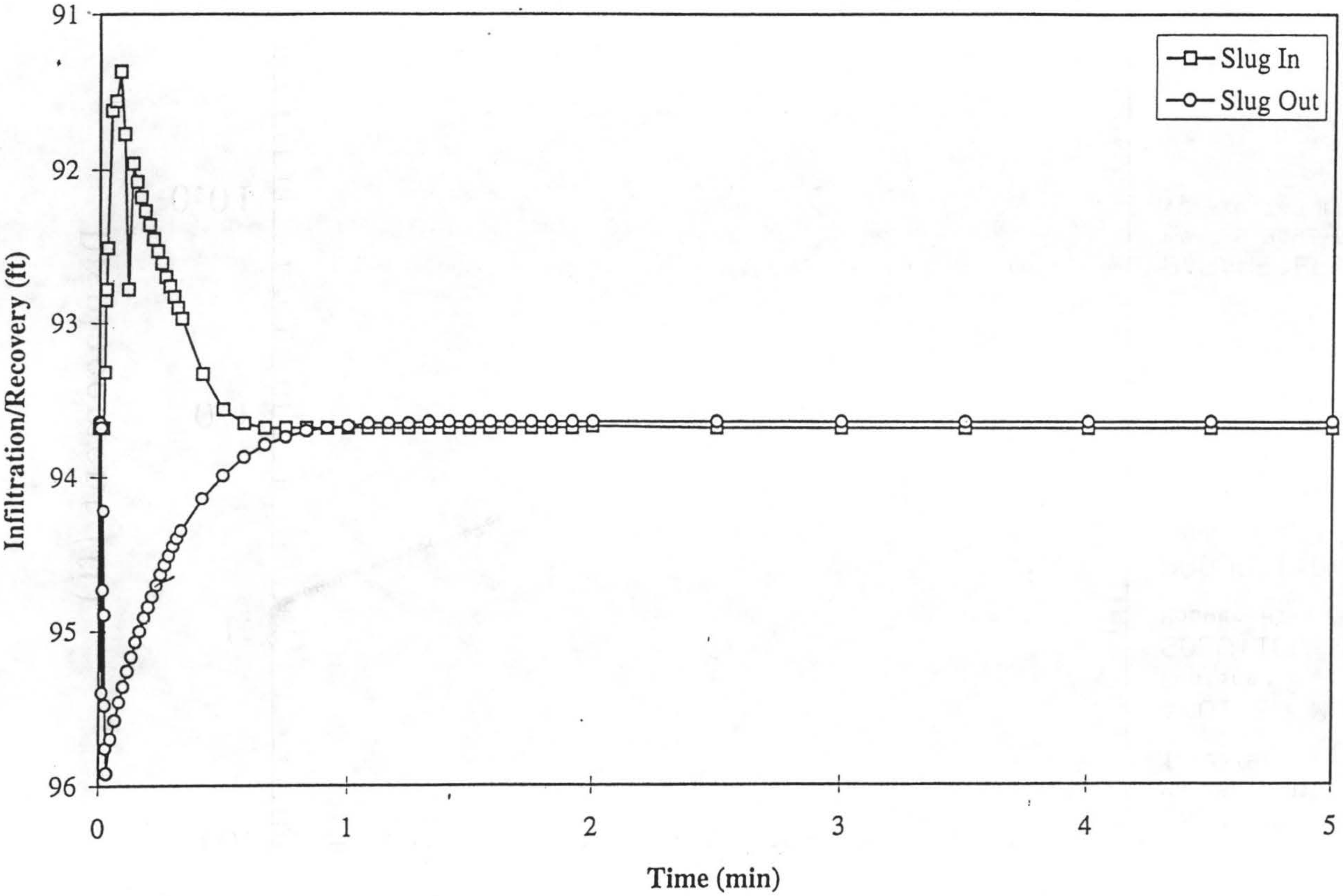
PARAMETER ESTIMATES:
K = 5.349E-05 ft/min
y0 = 0.743 ft

AQTESOLV

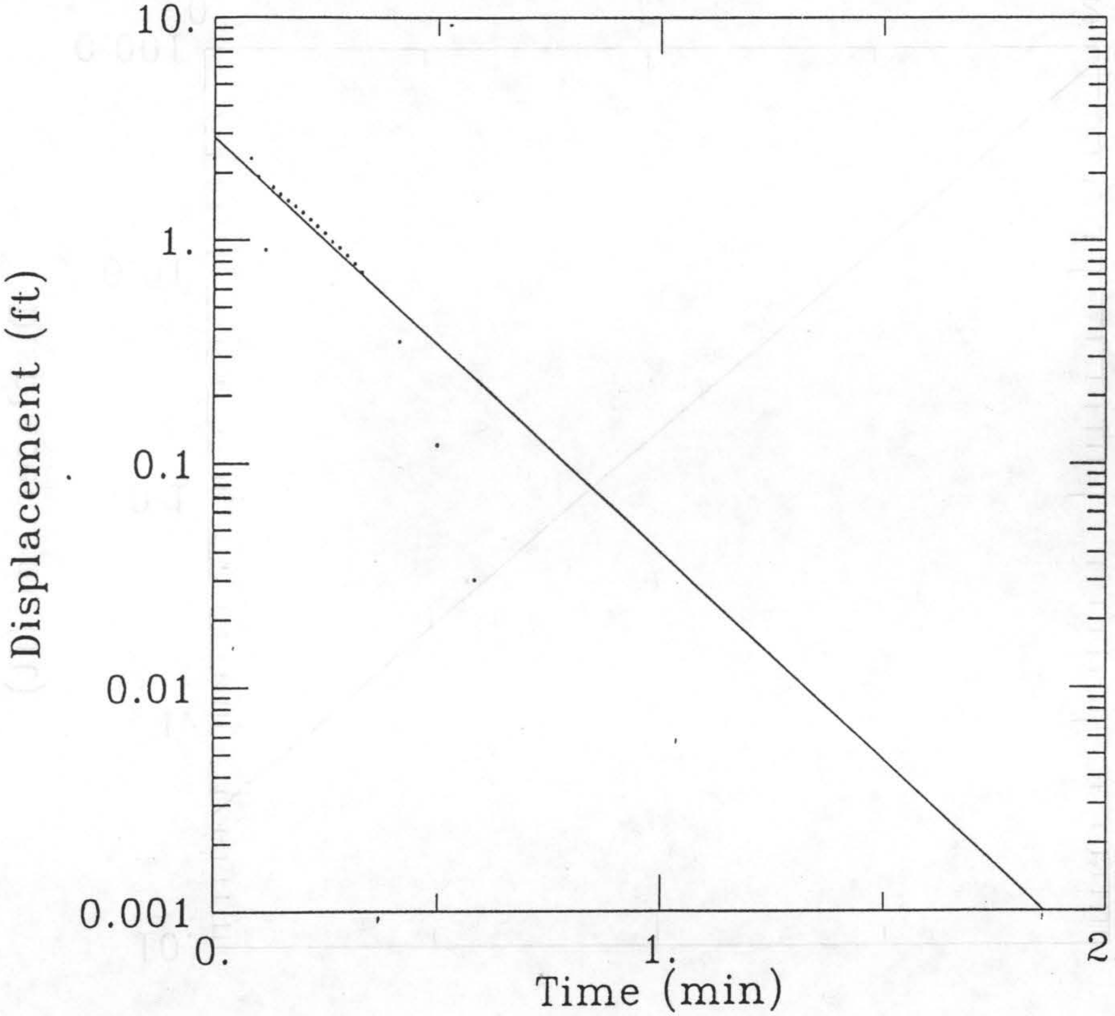
MW-22

~~P-31~~ Slug Test

JH 12/19/97



~~6127000~~ JH 12/19/97



DATA SET:
P31SI.DAT Mw-22
09/25/95

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

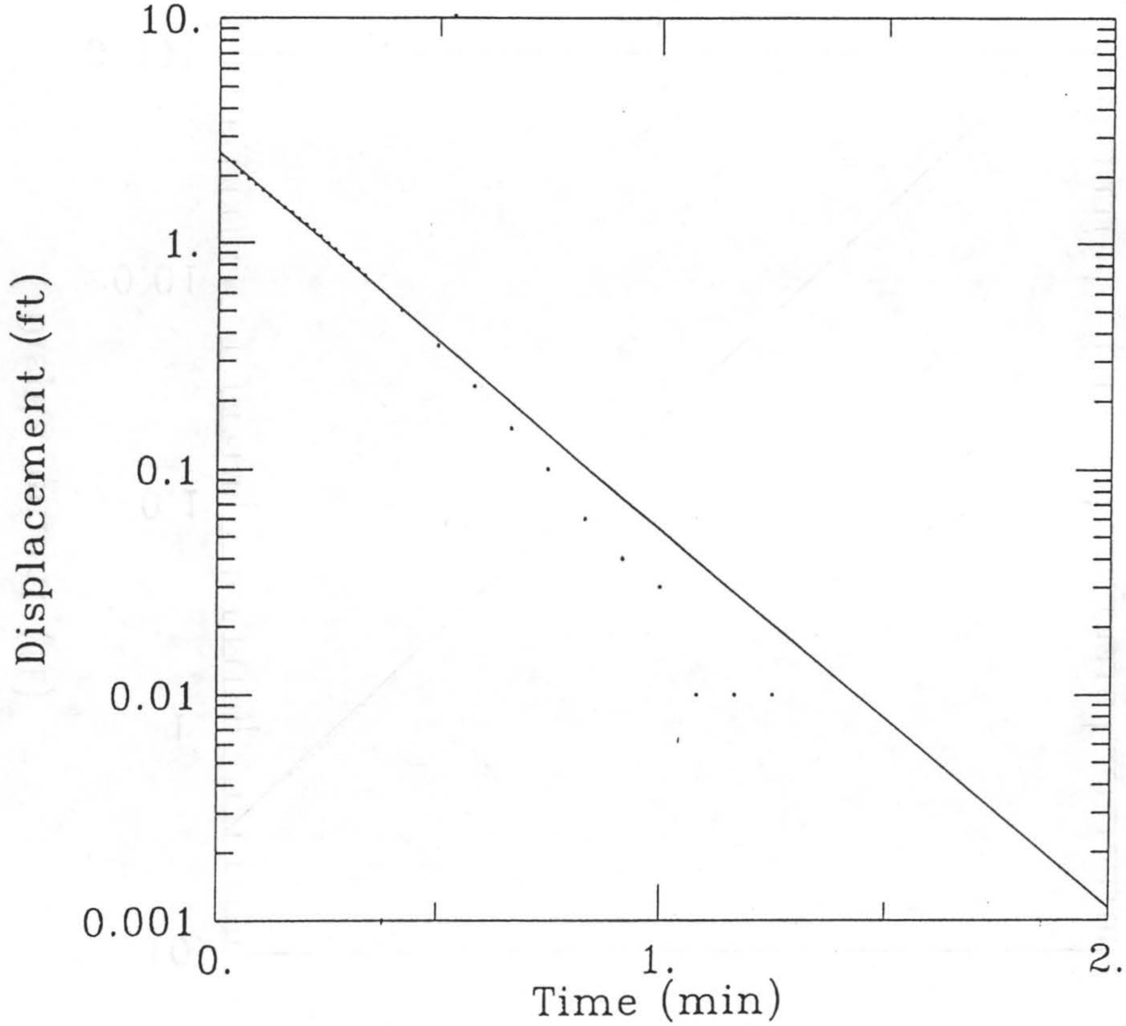
PROJECT DATA:
test date: 8/15/95

TEST DATA:
H0 = 2.31 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 27.5 ft
H = 27.5 ft

PARAMETER ESTIMATES:
K = 0.005093 ft/min
y0 = 2.889 ft

AQTESOLV

~~0034000~~ 0034050 JH 12/19/97



DATA SET:
P31SO.DAT MW-22
09/25/95

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/15/95

TEST DATA:
H0 = 2.31 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 27.5 ft
H = 27.5 ft

PARAMETER ESTIMATES:
K = 0.004596 ft/min
y0 = 2.55 ft

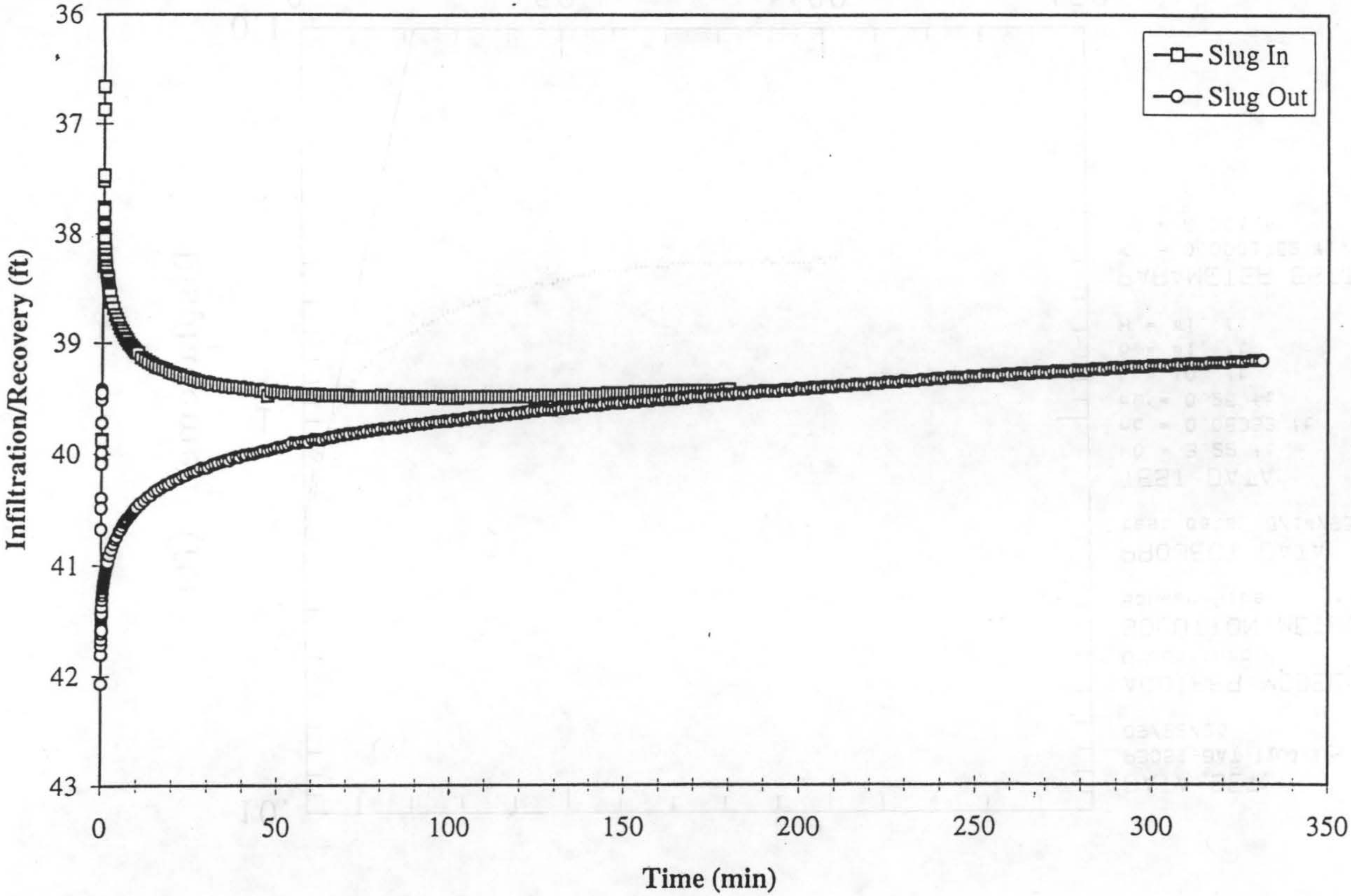
AQTESOLV

~~ISP000~~
12/15/97

Mw-23

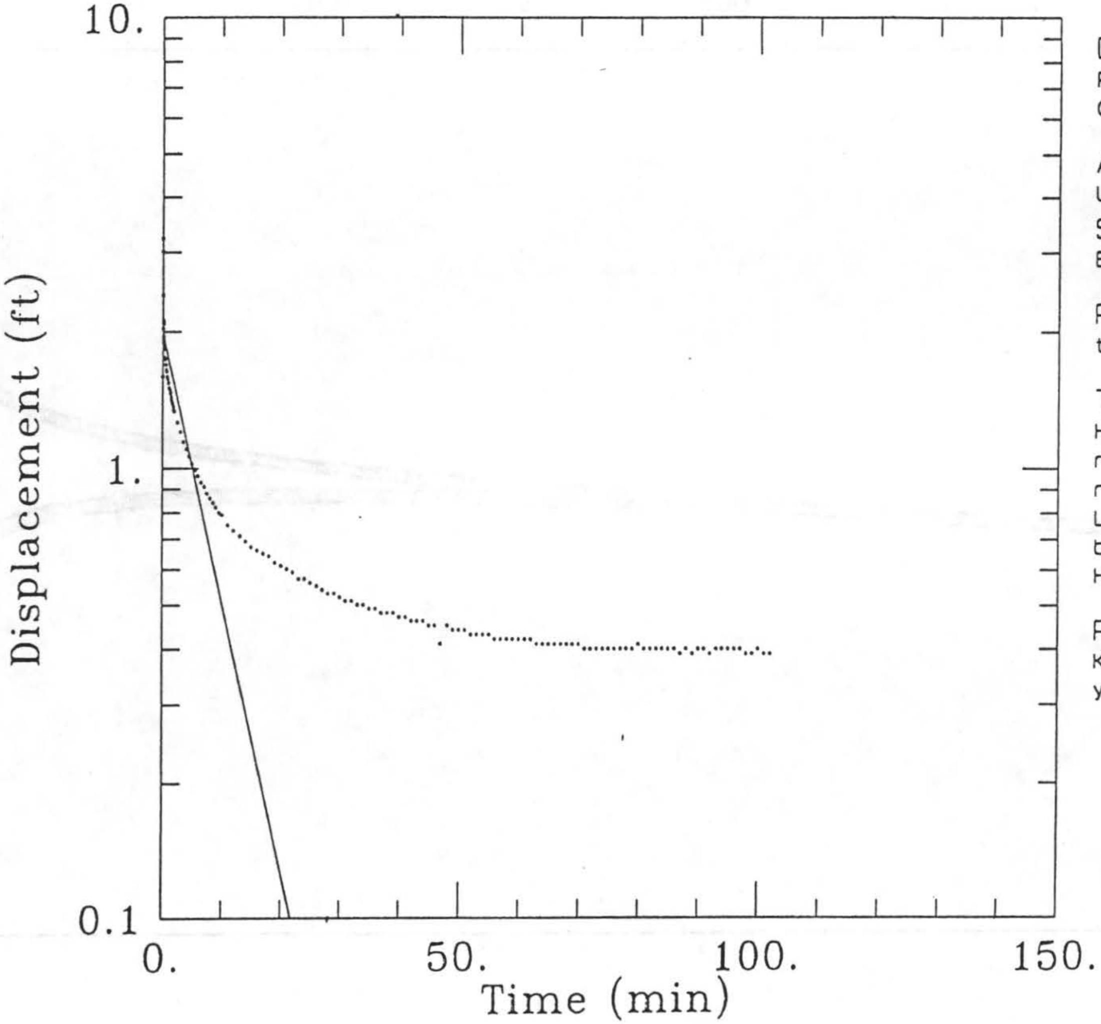
~~P-30~~ Slug Test

JH 12/19/97



~~0000446~~

JH 12/19/97



DATA SET:
P30SI.DAT MW-23
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

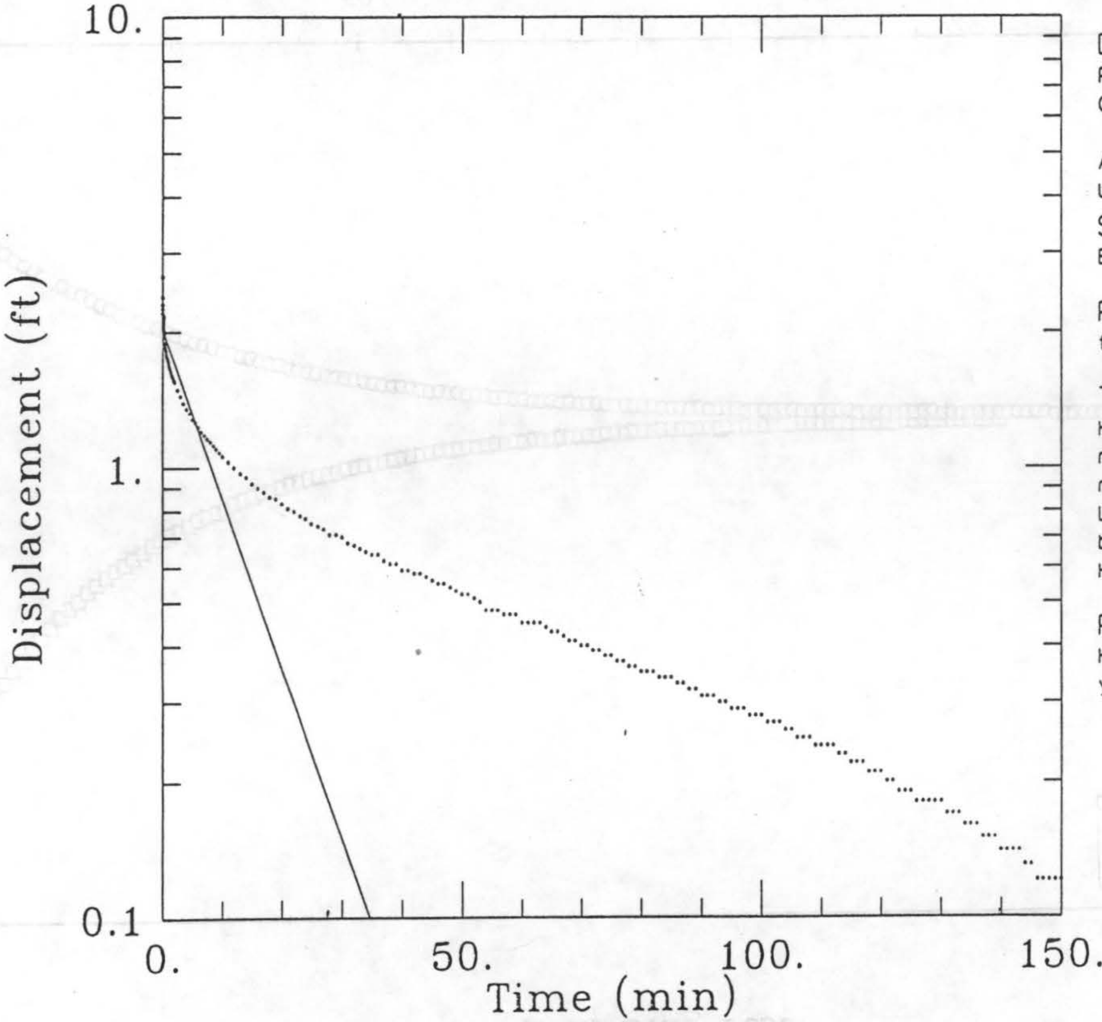
PROJECT DATA:
test date: 8/14/95

TEST DATA:
H0 = 3.22 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 41. ft
H = 41. ft

PARAMETER ESTIMATES:
K = 0.0001752 ft/min
y0 = 2.001 ft

AQTESOLV

~~000447~~



DATA SET:
P30S0.DAT MW-23
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/14/95

TEST DATA:
H0 = 2.65 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 41. ft
H = 41. ft

PARAMETER ESTIMATES:
K = 0.0001105 ft/min
y0 = 2.031 ft

AQTESOLV

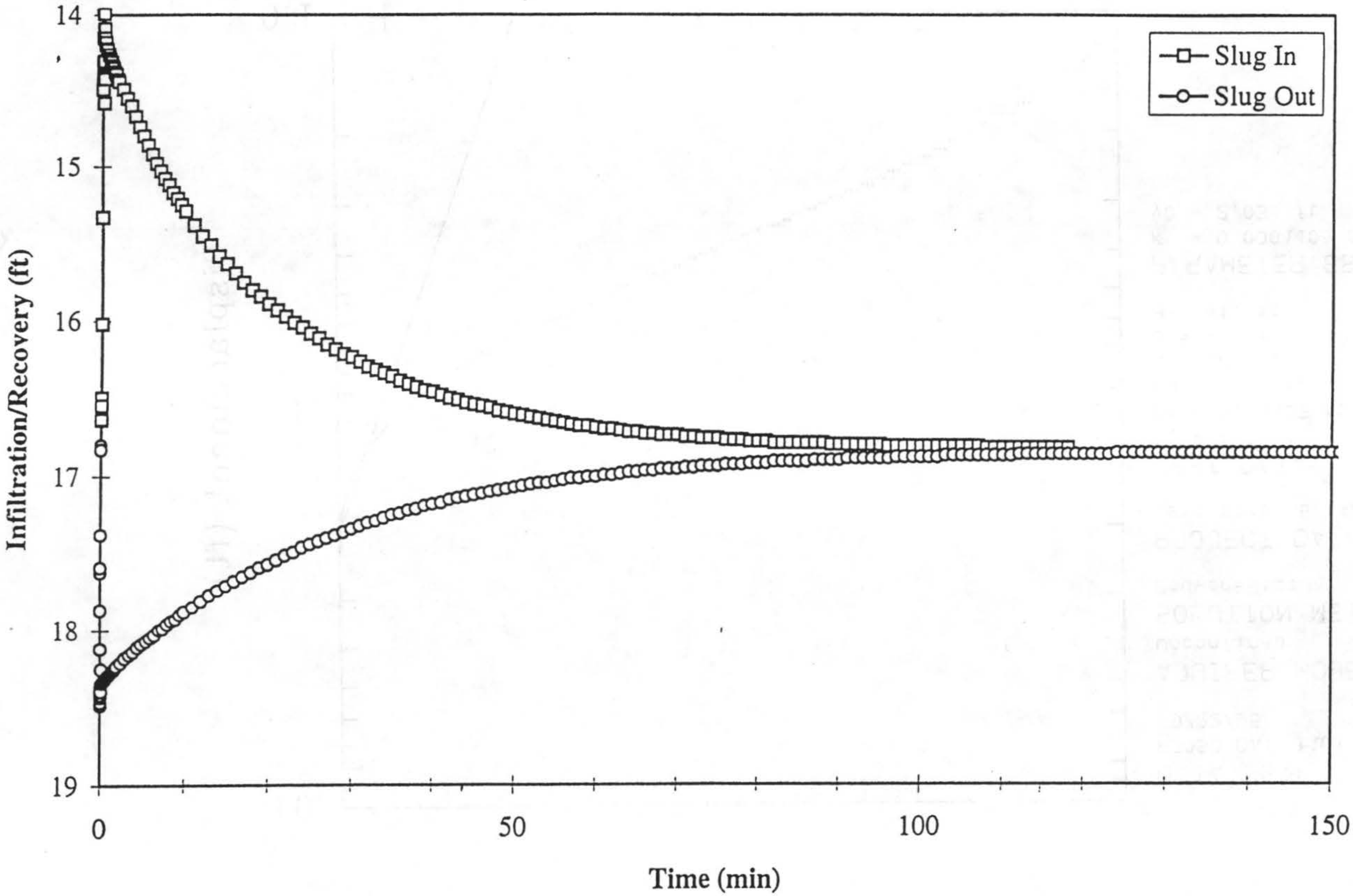
000448

JK 12/18/97

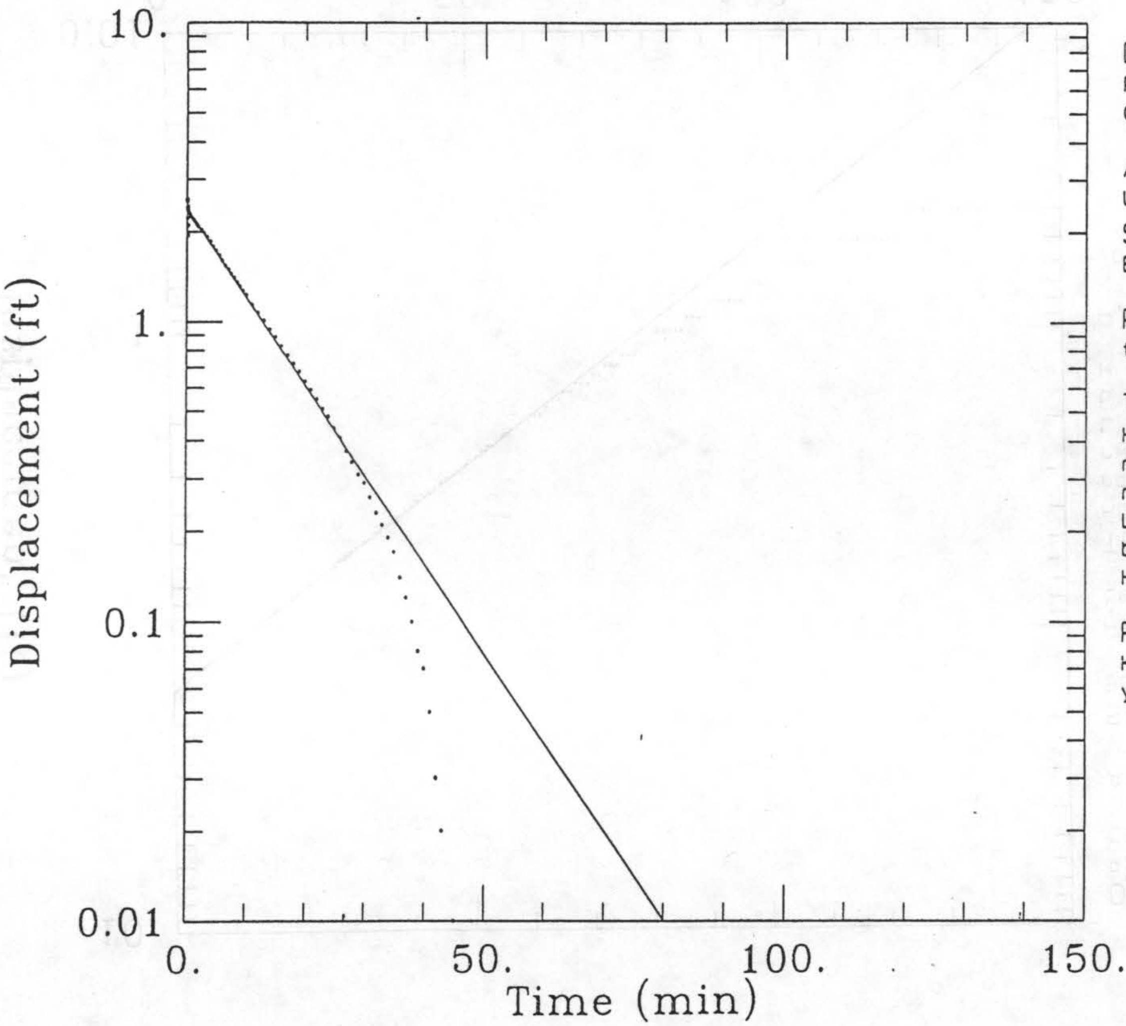
MW-24
~~MW-25D~~

~~P-29~~ Slug Test

JH 12/12/97



~~000443~~ JH 12/12/97



DATA SET:
P29SI.DAT MW-24
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

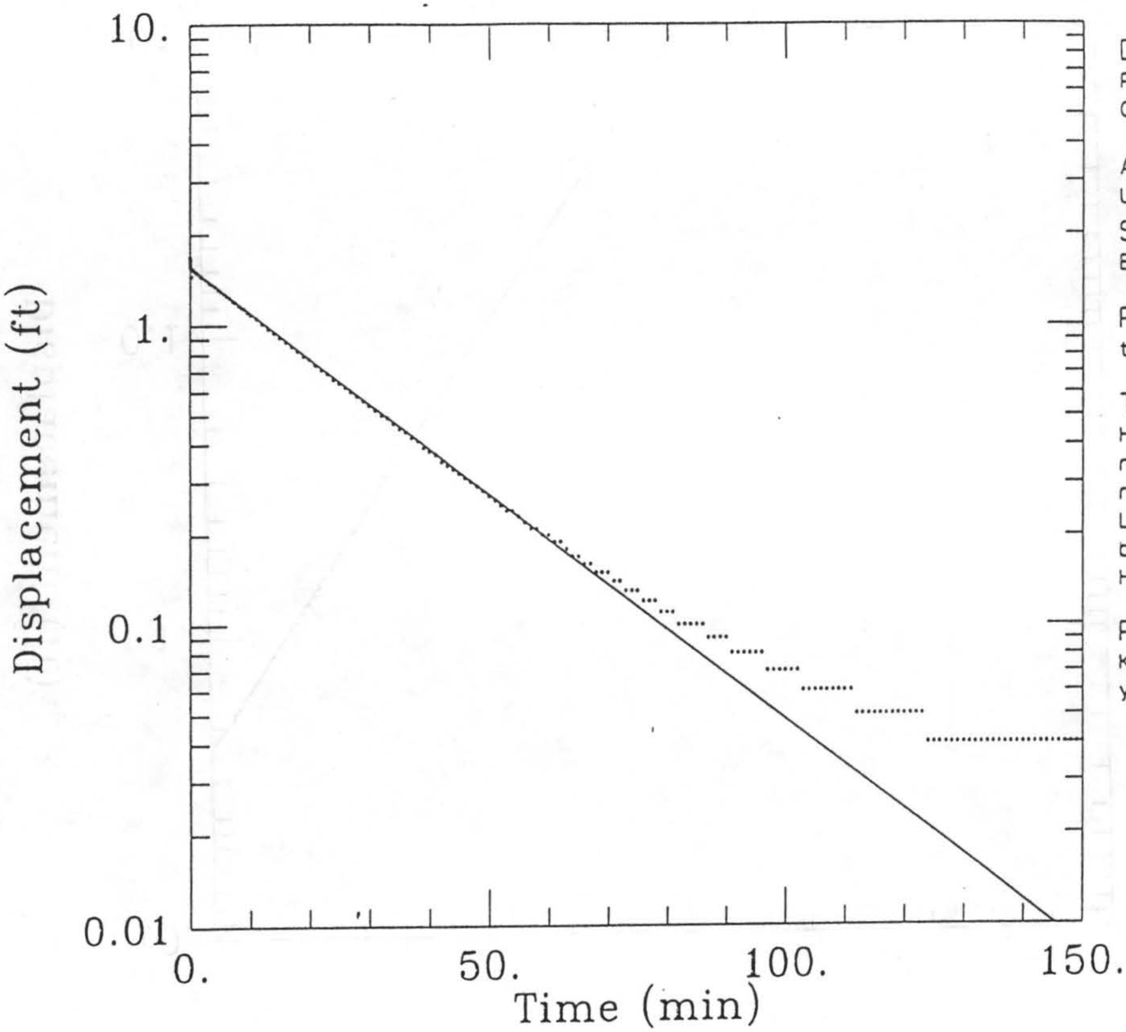
PROJECT DATA:
test date: 8/16/95

TEST DATA:
H0 = 2.57 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 59.5 ft
H = 59.5 ft

PARAMETER ESTIMATES:
K = 9.177E-05 ft/min
y0 = 2.384 ft

AQTESOLV

~~00044~~
AK 12/19/97



DATA SET:
P29SO.DAT mw-24
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/16/95

TEST DATA:
H0 = 1.68 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 59.5 ft
H = 59.5 ft

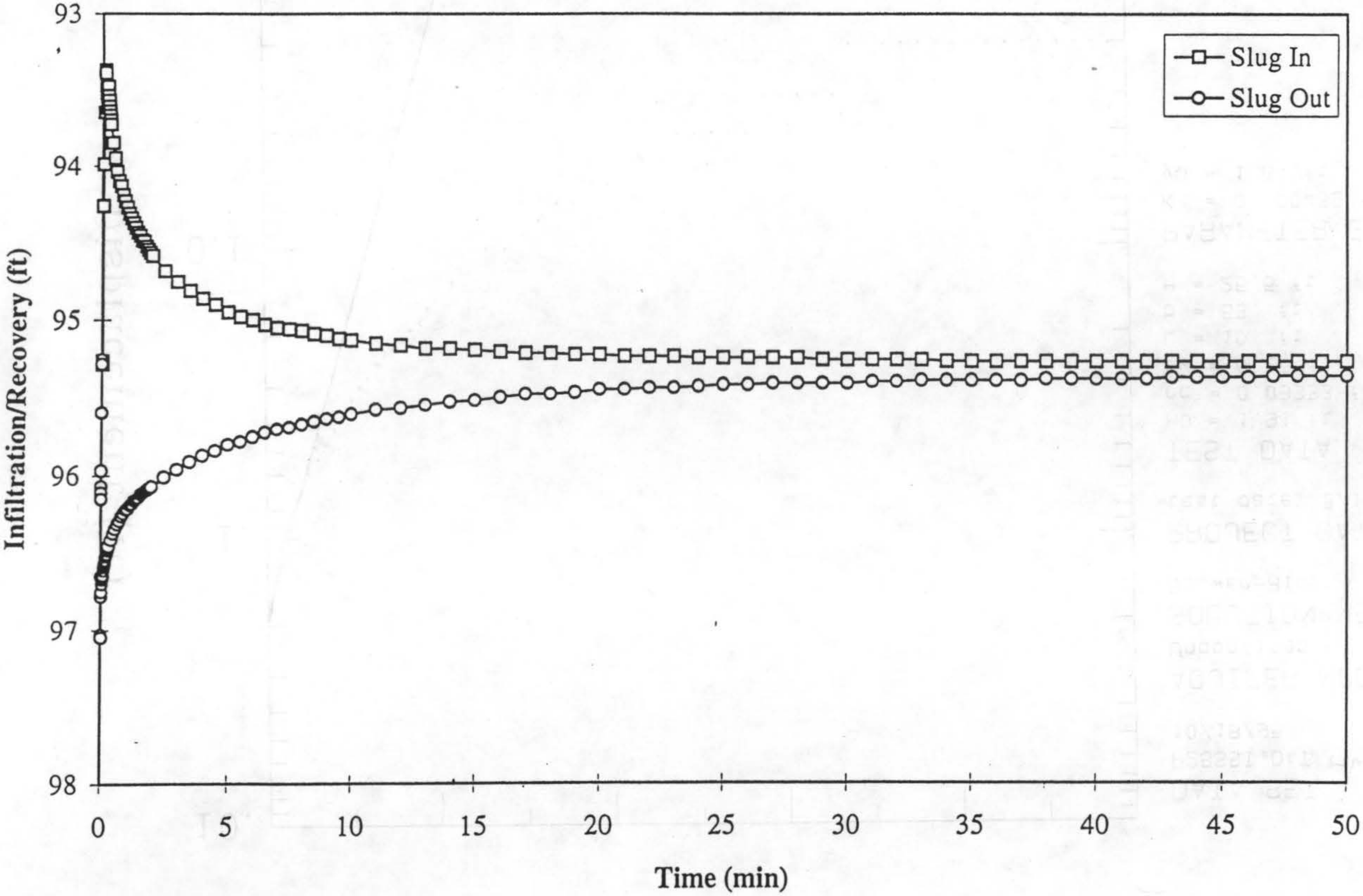
PARAMETER ESTIMATES:
K = 4.664E-05 ft/min
y0 = 1.551 ft

AQTESOLV

~~000000~~ 000445 # 12/15/97

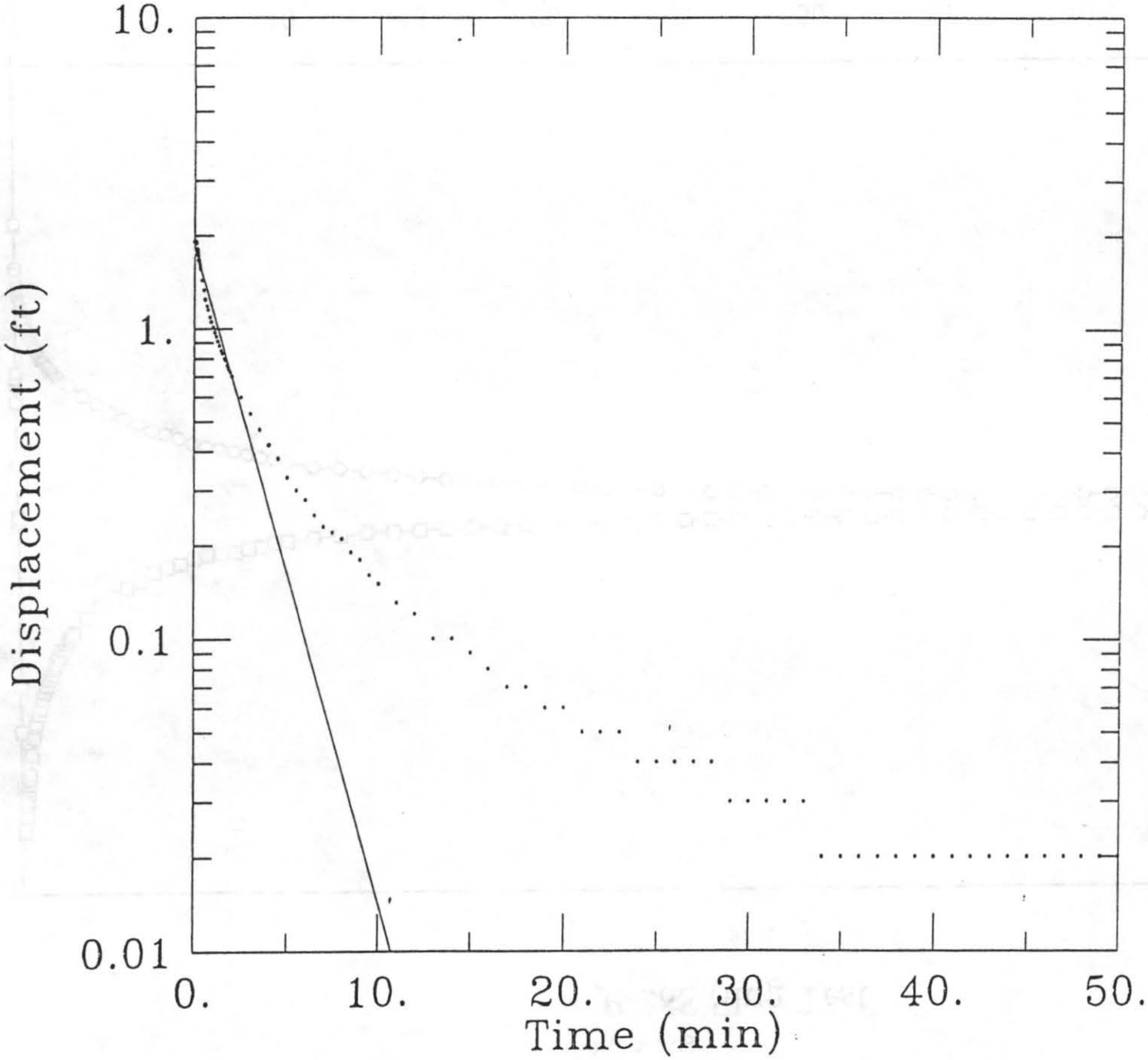
MW-25S

~~P-28S~~ Slug Test



~~0004437~~

JK 12/19/52



DATA SET:
P28SSI.DAT MW-25S
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

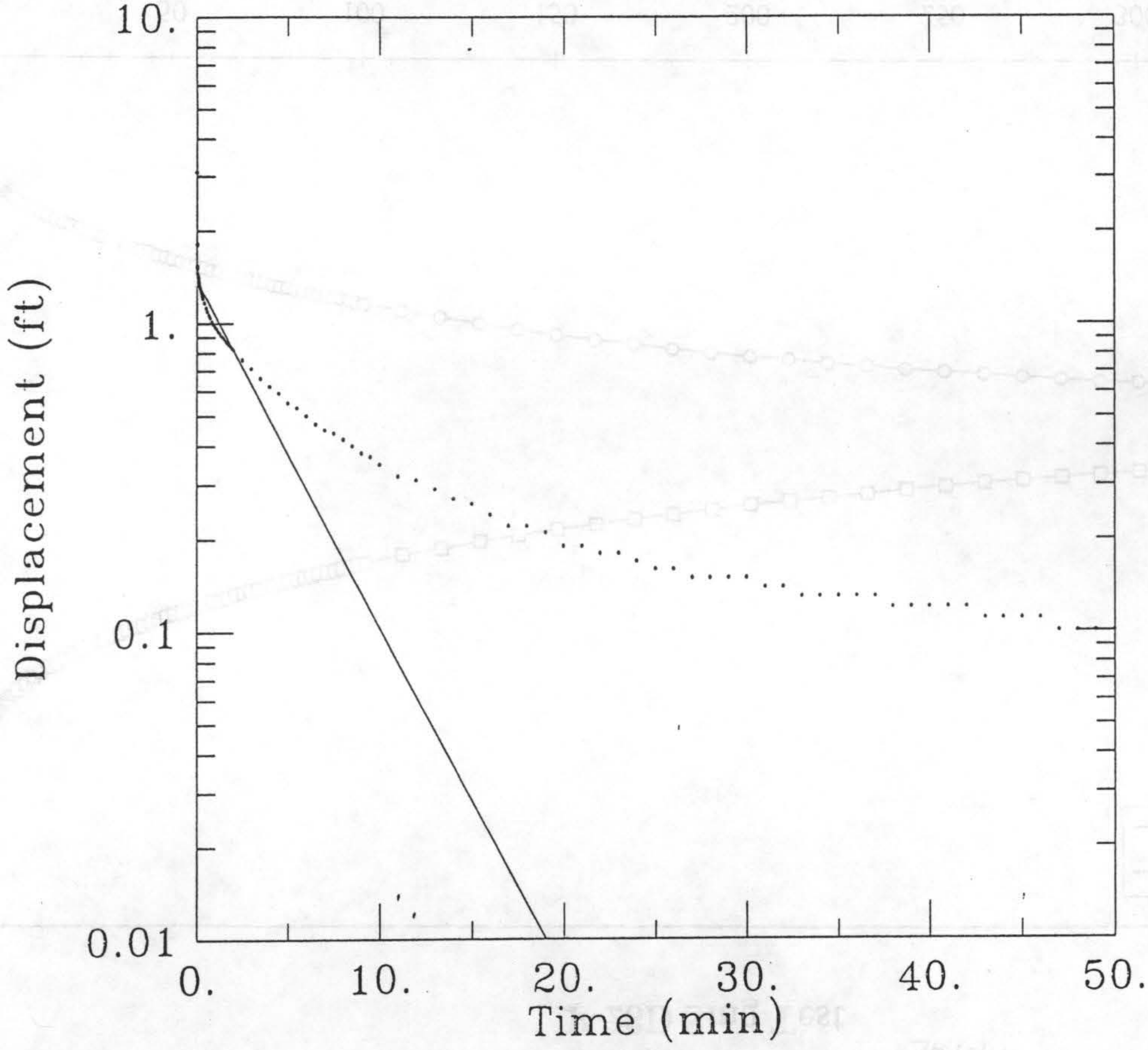
PROJECT DATA:
test date: 8/15/95

TEST DATA:
H0 = 1.91 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 53. ft
H = 25.5 ft

PARAMETER ESTIMATES:
K = 0.000459 ft/min
y0 = 1.84 ft

AQTESOLV

~~00017~~ 00438 JF 12/15/97



DATA SET:
P28SSO.DAT MW-25S
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/15/95

TEST DATA:
H0 = 3.1 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 53. ft
H = 25.5 ft

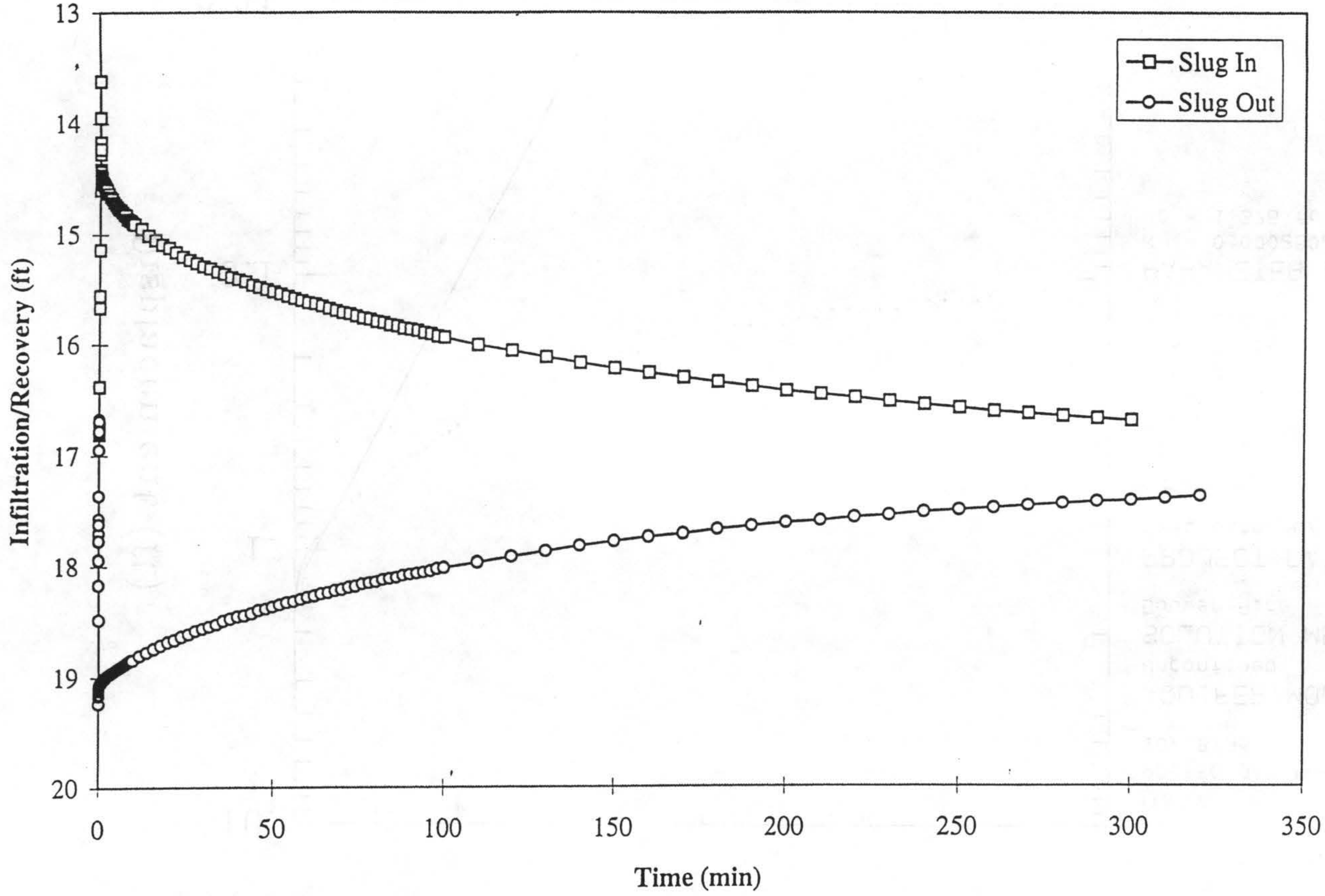
PARAMETER ESTIMATES:
K = 0.0002502 ft/min
y0 = 1.376 ft

AQTESOLV

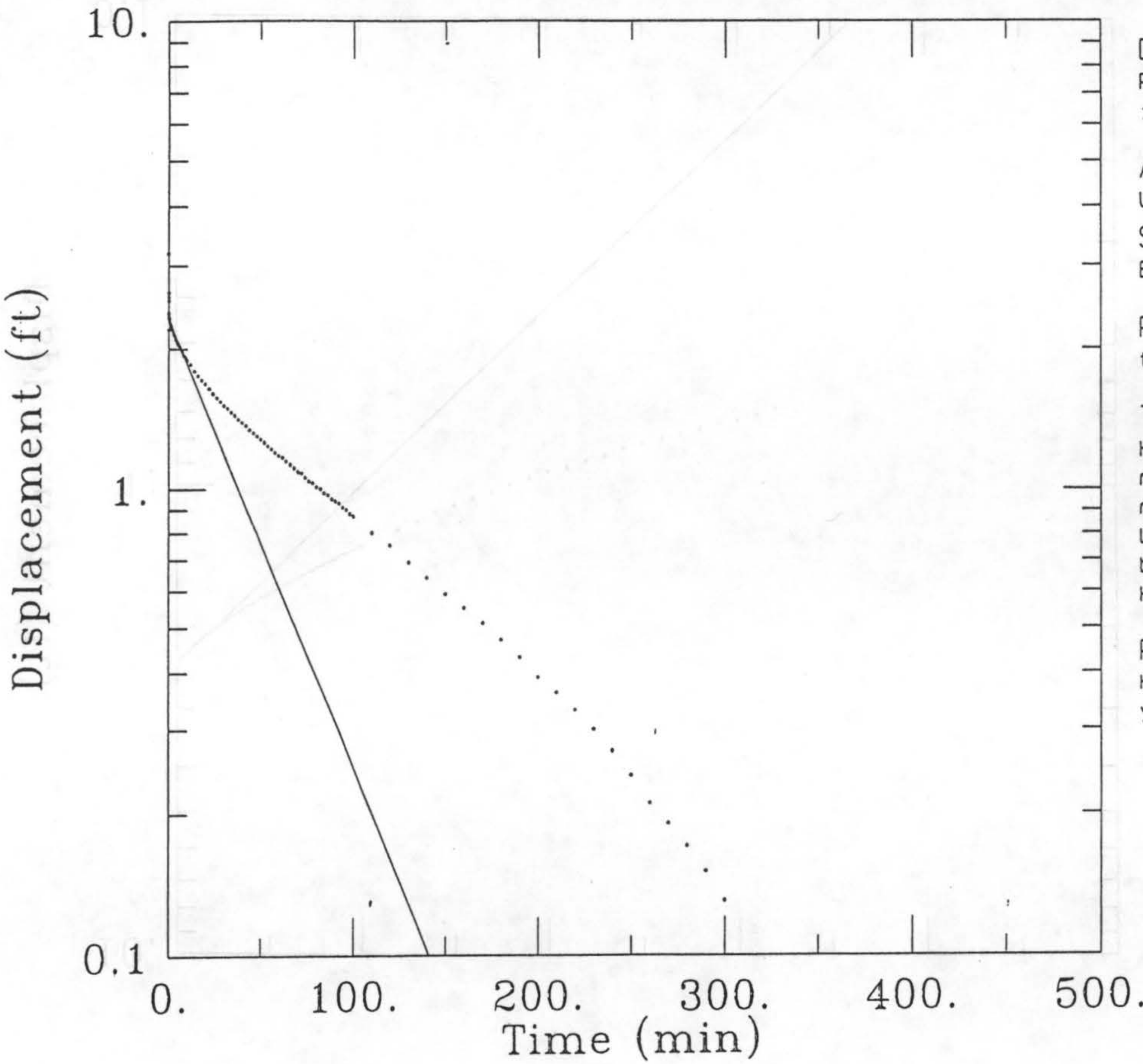
~~000~~4439
JH 12/15/97

MW-25D JH 12/19/97

~~P-28~~D Slug Test



0004410
12/19/97



DATA SET:
P28DSI.DAT MW-25D
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

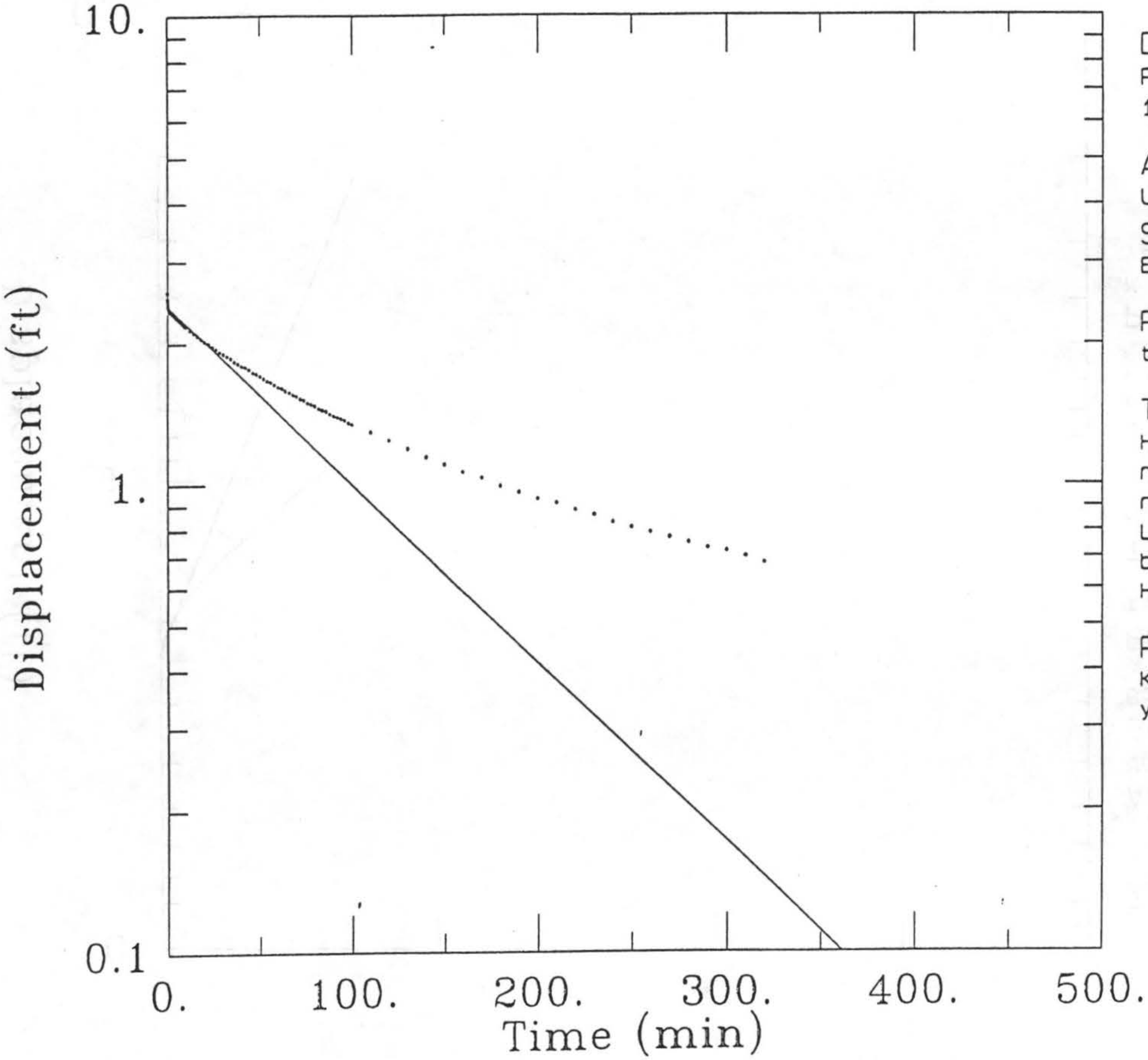
PROJECT DATA:
test date: 10/13/95

TEST DATA:
H0 = 3.18 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 53. ft
H = 53. ft

PARAMETER ESTIMATES:
K = 2.942E-05 ft/min
y0 = 2.316 ft

AQTESOLV

~~000441~~ JM 12/19/97



DATA SET:
P28DSO.DAT MW-25D
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 10/13/95

TEST DATA:
H0 = 2.57 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 53. ft
H = 53. ft

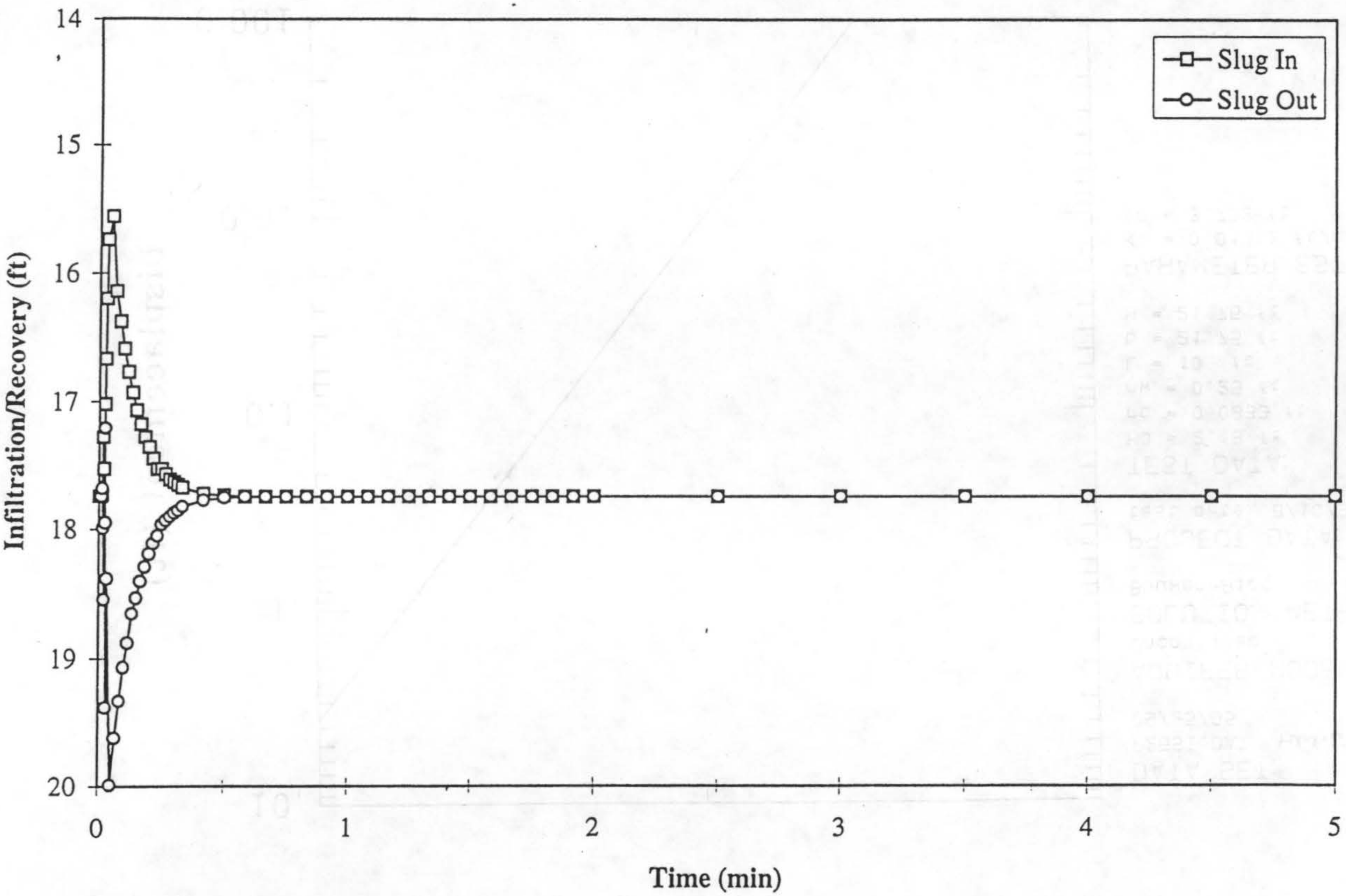
PARAMETER ESTIMATES:
K = 1.162E-05 ft/min
y0 = 2.408 ft

AQTESOLV

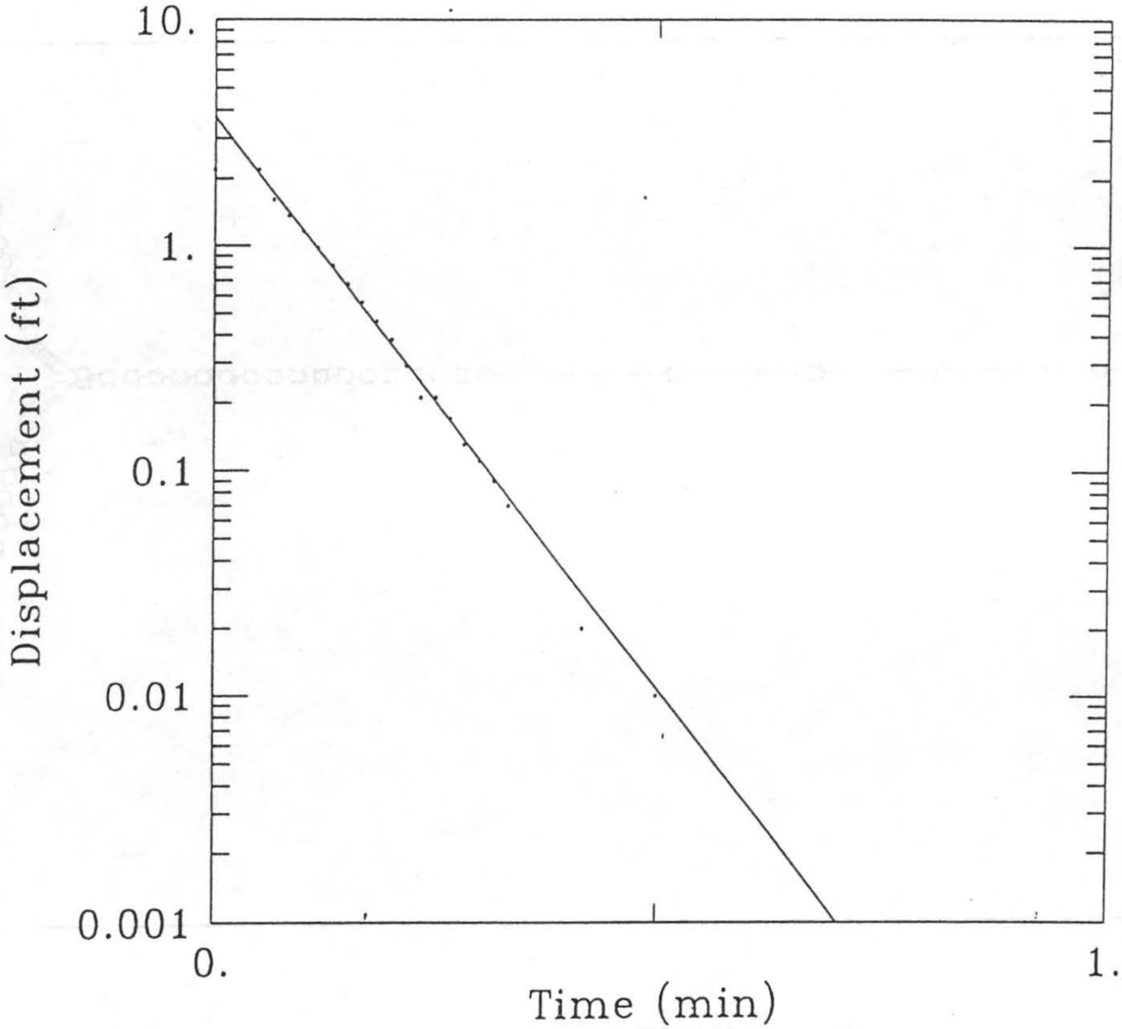
~~2747000~~ 12/19/97

Mw-27 JH 12/19/97

~~P-26~~ Slug Test



0004337 JH 12/19/97



DATA SET:
P26SI.DAT MW-27
09/25/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

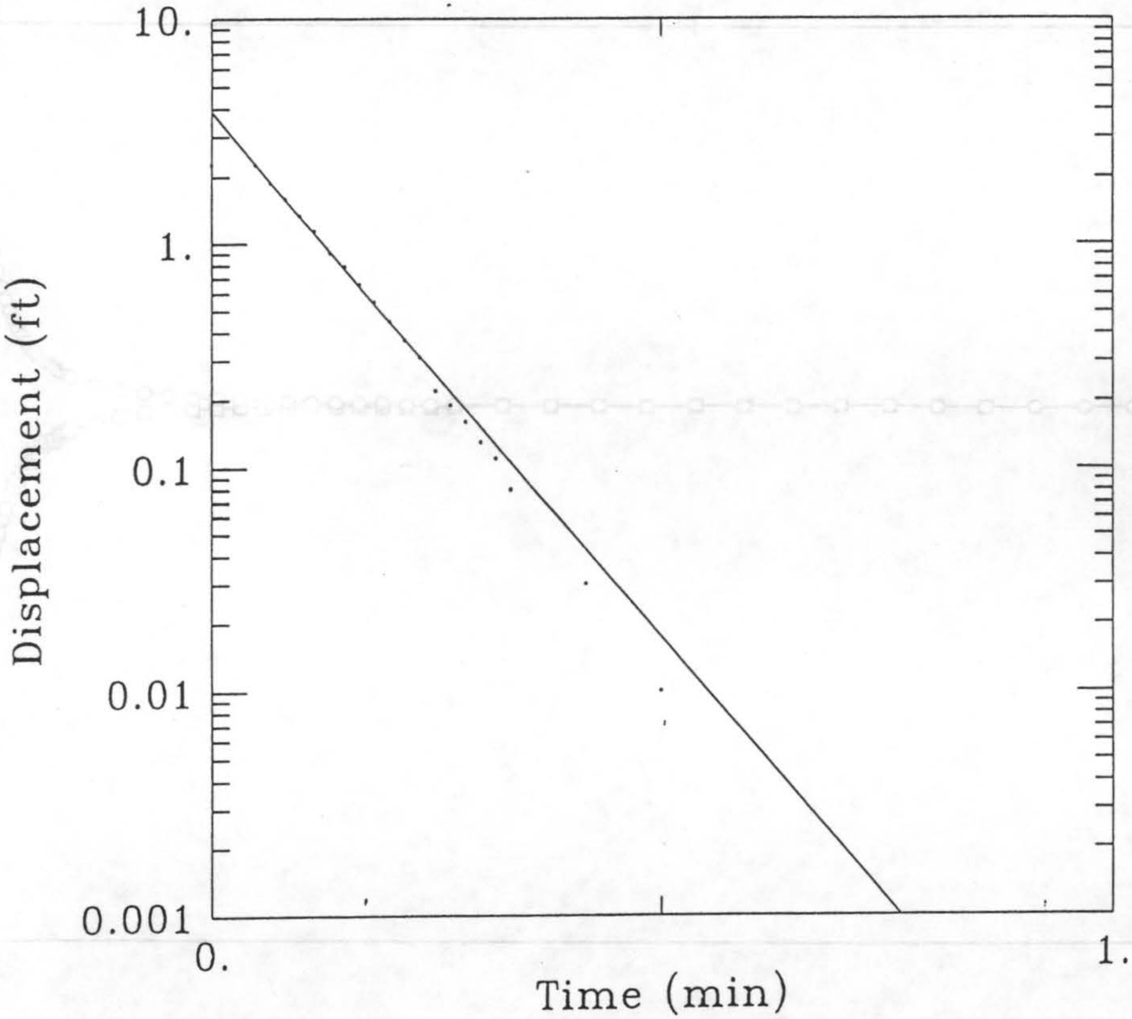
PROJECT DATA:
test date: 8/10/95

TEST DATA:
H0 = 2.18 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 21.75 ft
H = 21.75 ft

PARAMETER ESTIMATES:
K = 0.01335 ft/min
y0 = 3.732 ft

AQTESOLV

0004435
12/19/97



DATA SET:
P26S0.DAT rcw-27
09/25/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/10/95

TEST DATA:
H0 = 2.25 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 21.75 ft
H = 21.75 ft

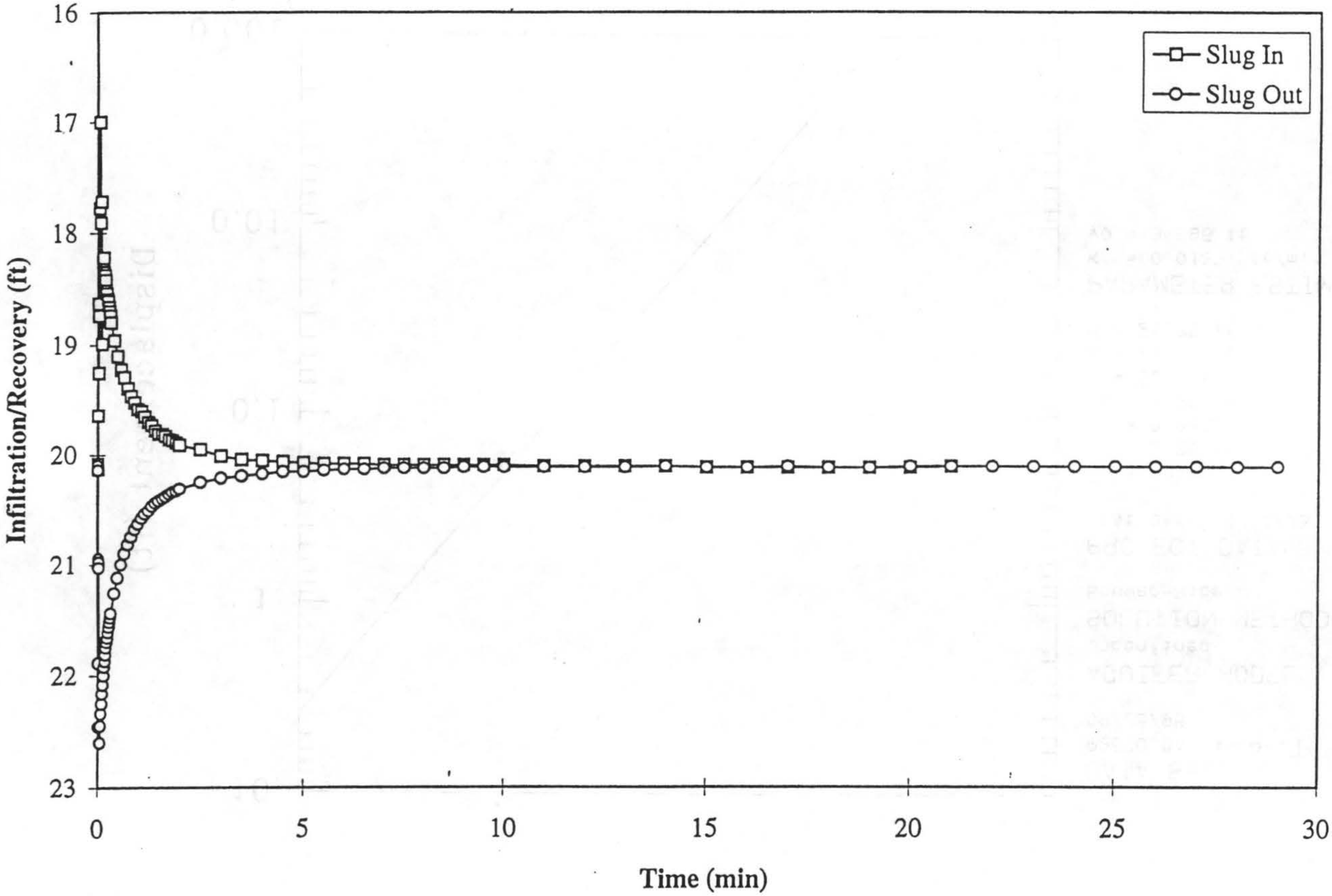
PARAMETER ESTIMATES:
K = 0.01237 ft/min
y0 = 3.896 ft

AQTESOLV

000136

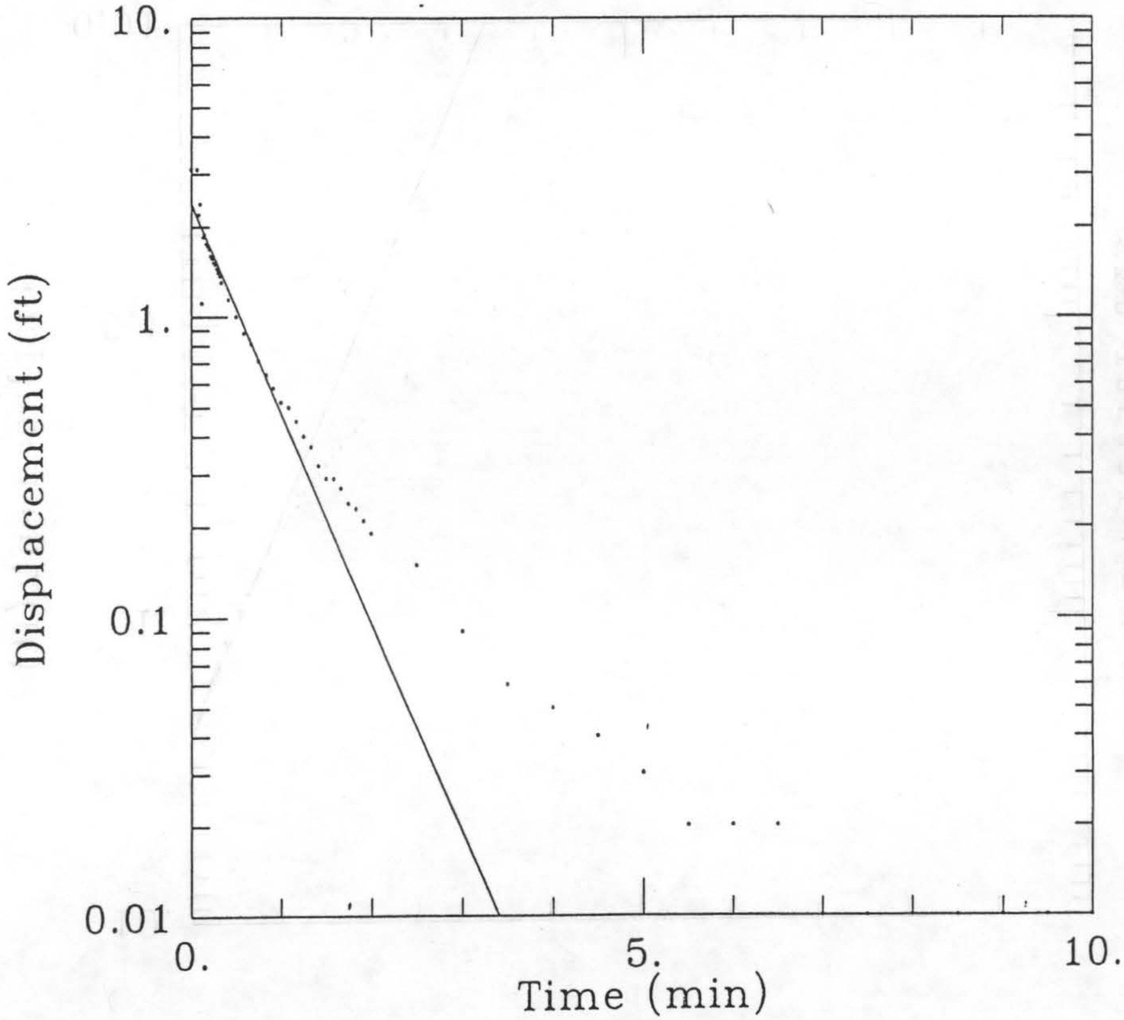
JH 12/19/97

MW-28
~~P-25~~ Slug Test 12/19/97



0004731

12/19/97



DATA SET:
P25SI.DAT MW-28
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

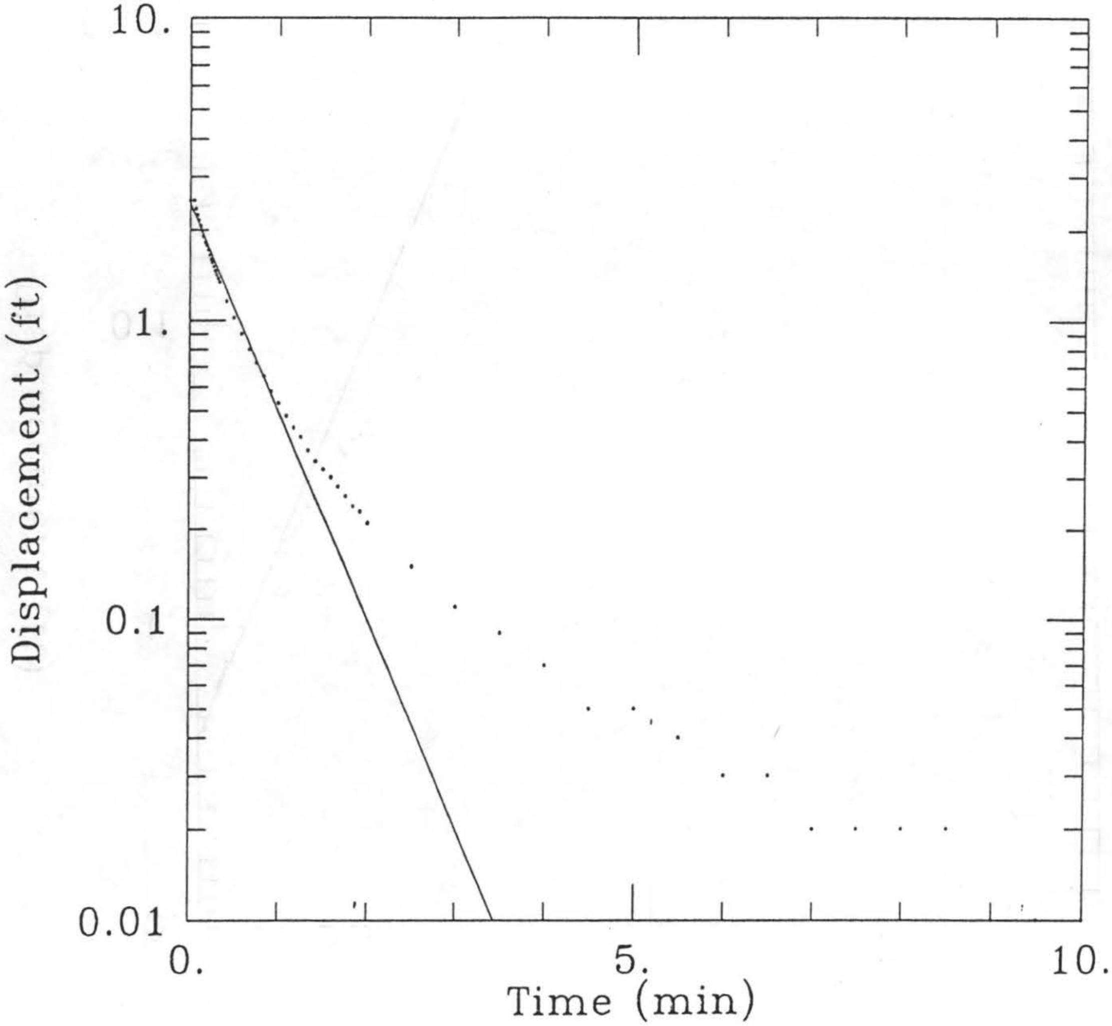
PROJECT DATA:
test date: 8/1/95

TEST DATA:
H0 = 3.1 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 40.5 ft
H = 40.5 ft

PARAMETER ESTIMATES:
K = 0.002041 ft/min
y0 = 2.38 ft

AQTESOLV

~~000432~~ JH 12/19/97



DATA SET:
P25S0.DAT MW-28
09/22/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

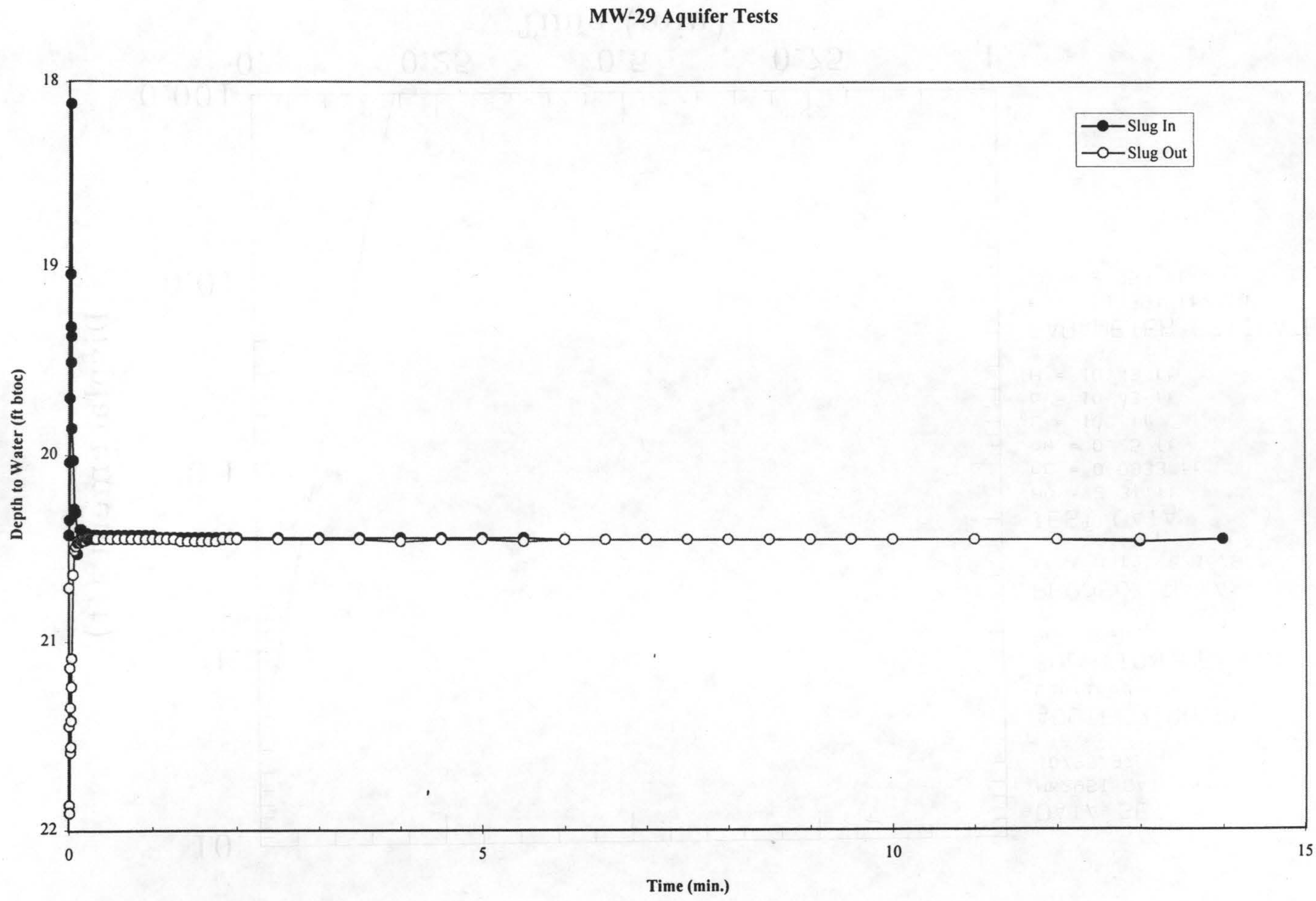
PROJECT DATA:
test date: 8/1/95

TEST DATA:
H0 = 2.5 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 40.5 ft
H = 40.5 ft

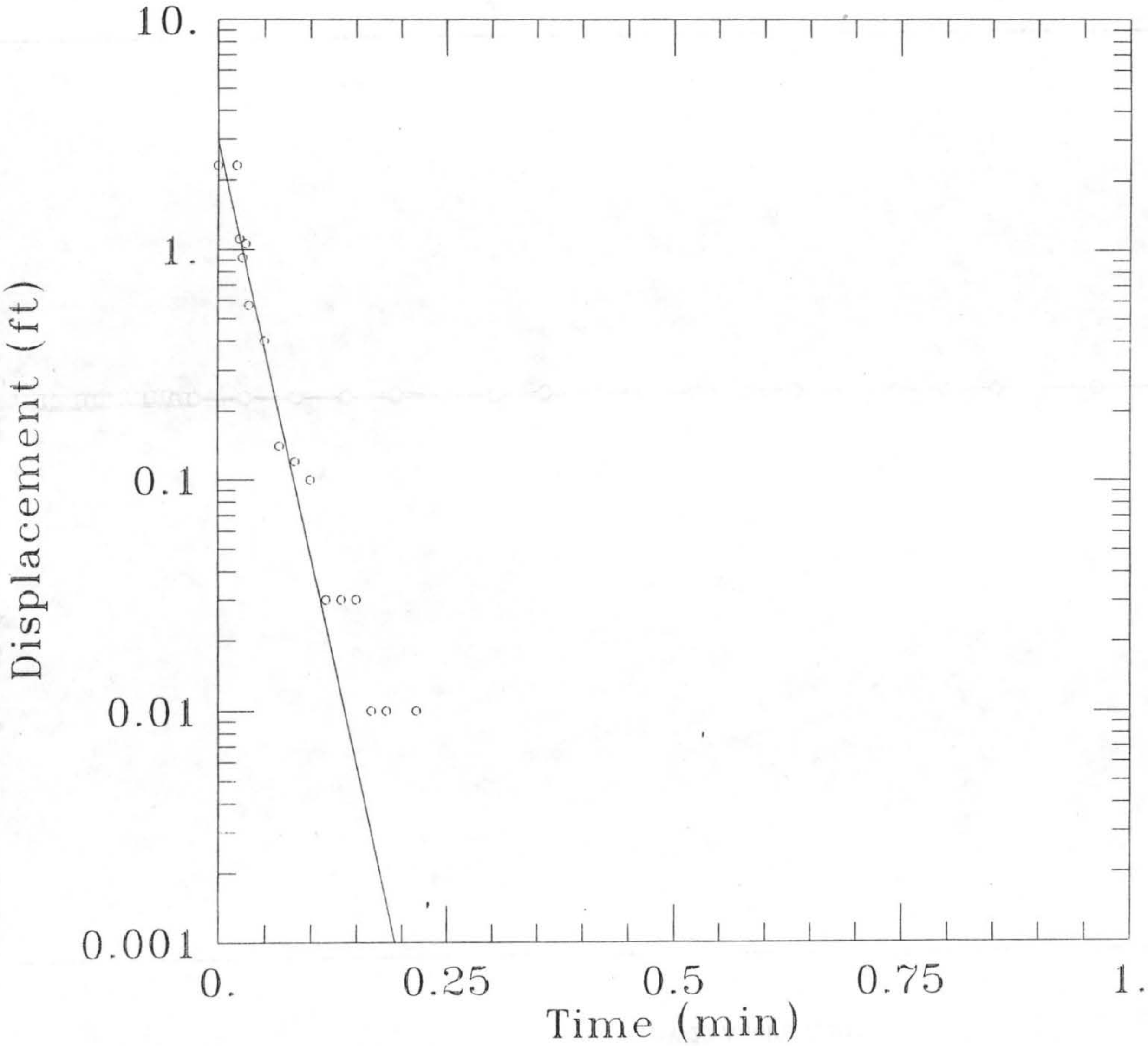
PARAMETER ESTIMATES:
K = 0.002031 ft/min
y0 = 2.438 ft

AQTESOLV

~~0000433~~ 12/19/97



MW-29 Aquifer Tests
Slug In
Slug Out
Depth to Water (ft btoc)
18
19
20
21
22
0
5
10
15
Time (min.)



DATA SET:
MW29SI.DAT
10/23/97

AQUIFER MODEL:
Confined

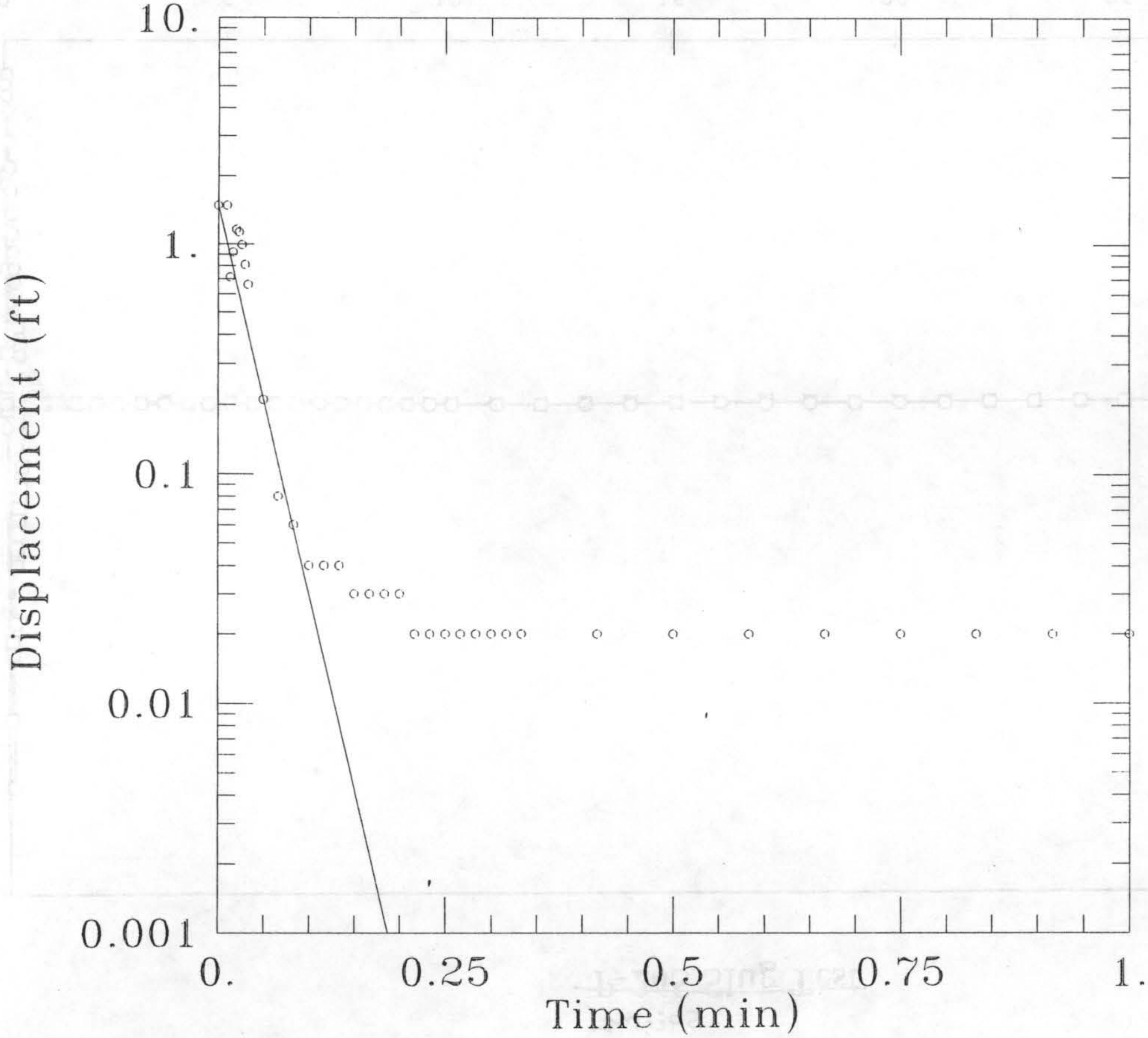
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/16/97

TEST DATA:
H0 = 2.31 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 10.43 ft
H = 10.43 ft

PARAMETER ESTIMATES:
K = 0.1391 ft/min
y0 = 2.955 ft

AQTESOLV



DATA SET:
MW29SO.DAT
10/23/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/16/97

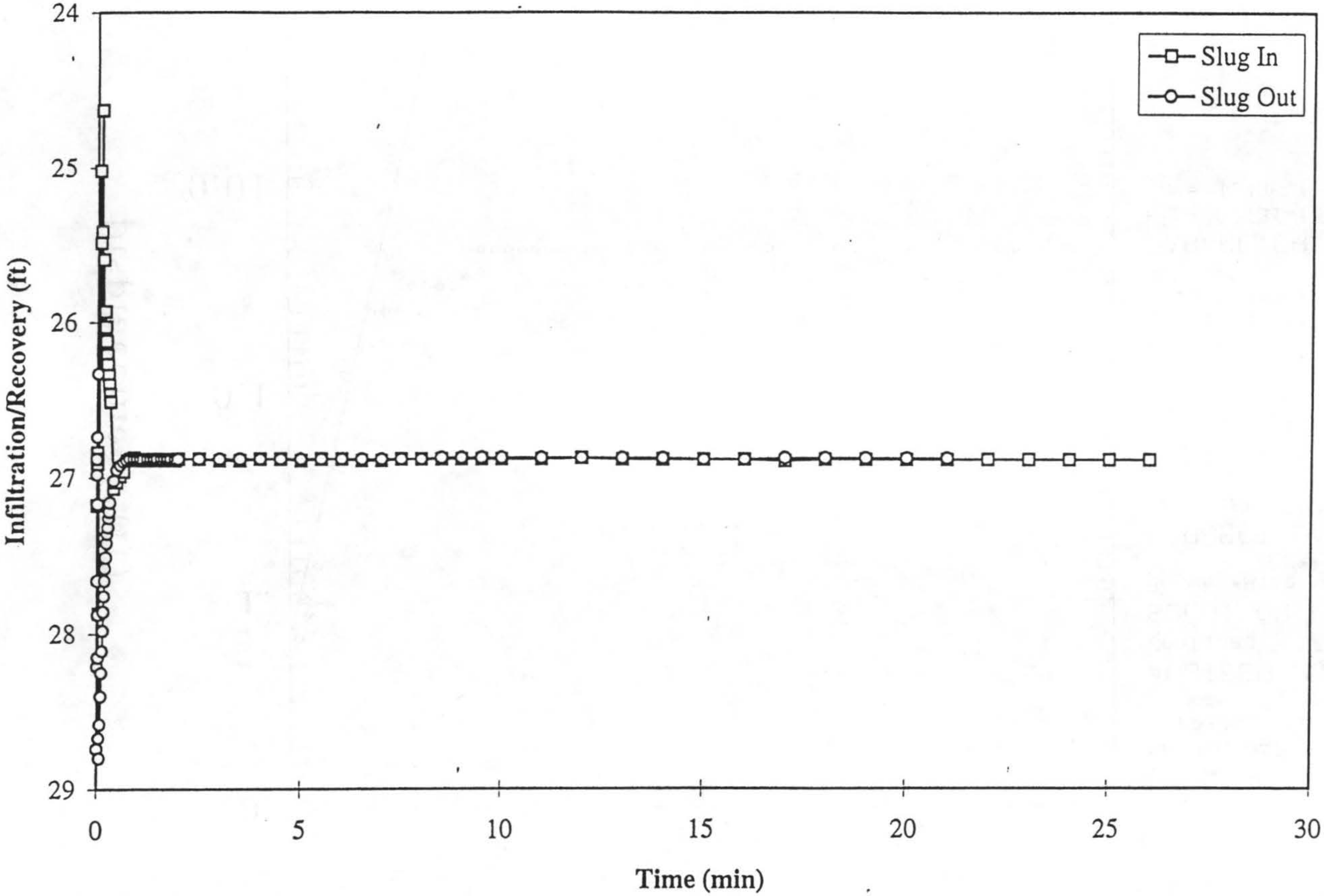
TEST DATA:
H0 = 1.48 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 10.43 ft
H = 10.43 ft

PARAMETER ESTIMATES:
K = 0.131 ft/min
y0 = 1.486 ft

AQTESOLV

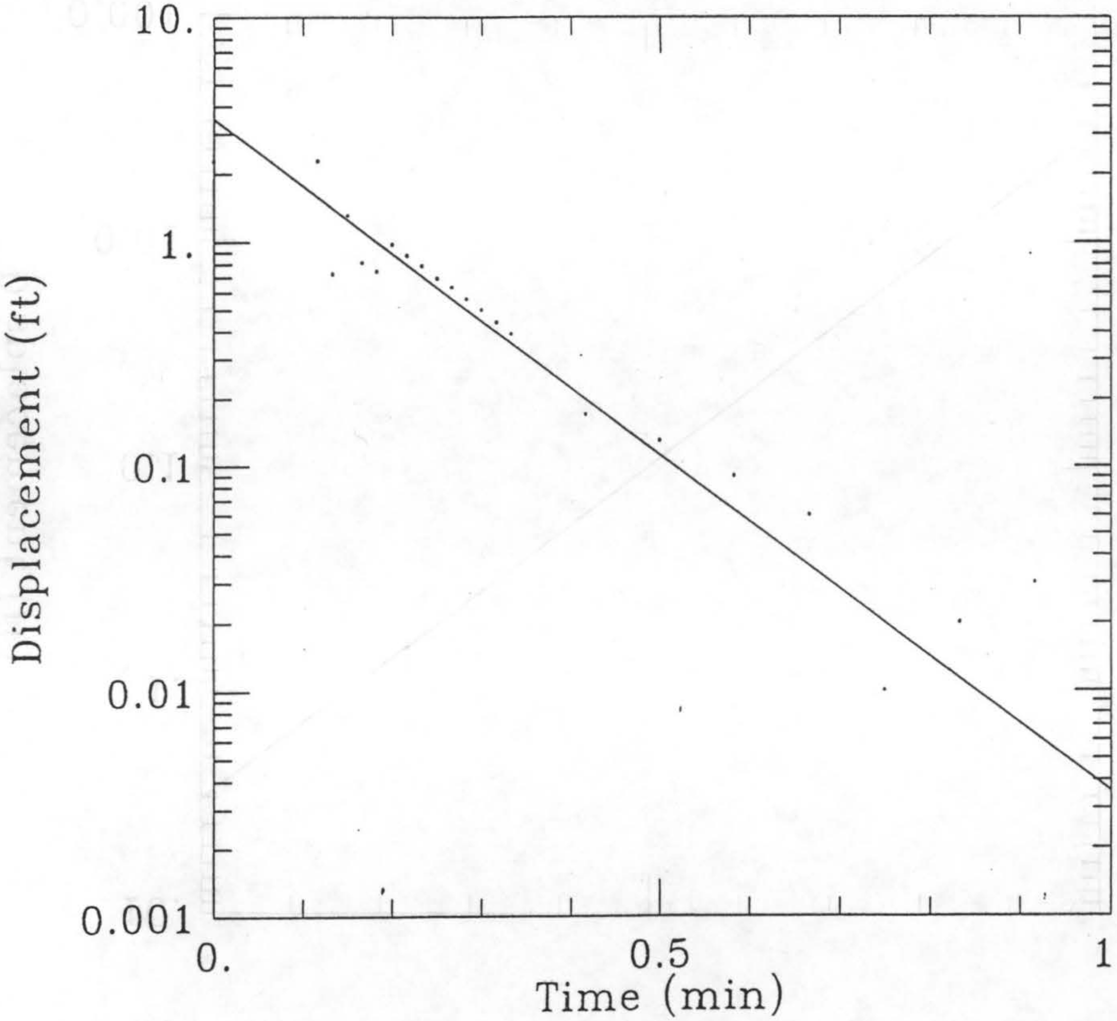
MW-30S

~~P-24S Slug Test~~



000425

12/9/97



DATA SET:
P24SSI.DAT   mw-30S
09/21/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

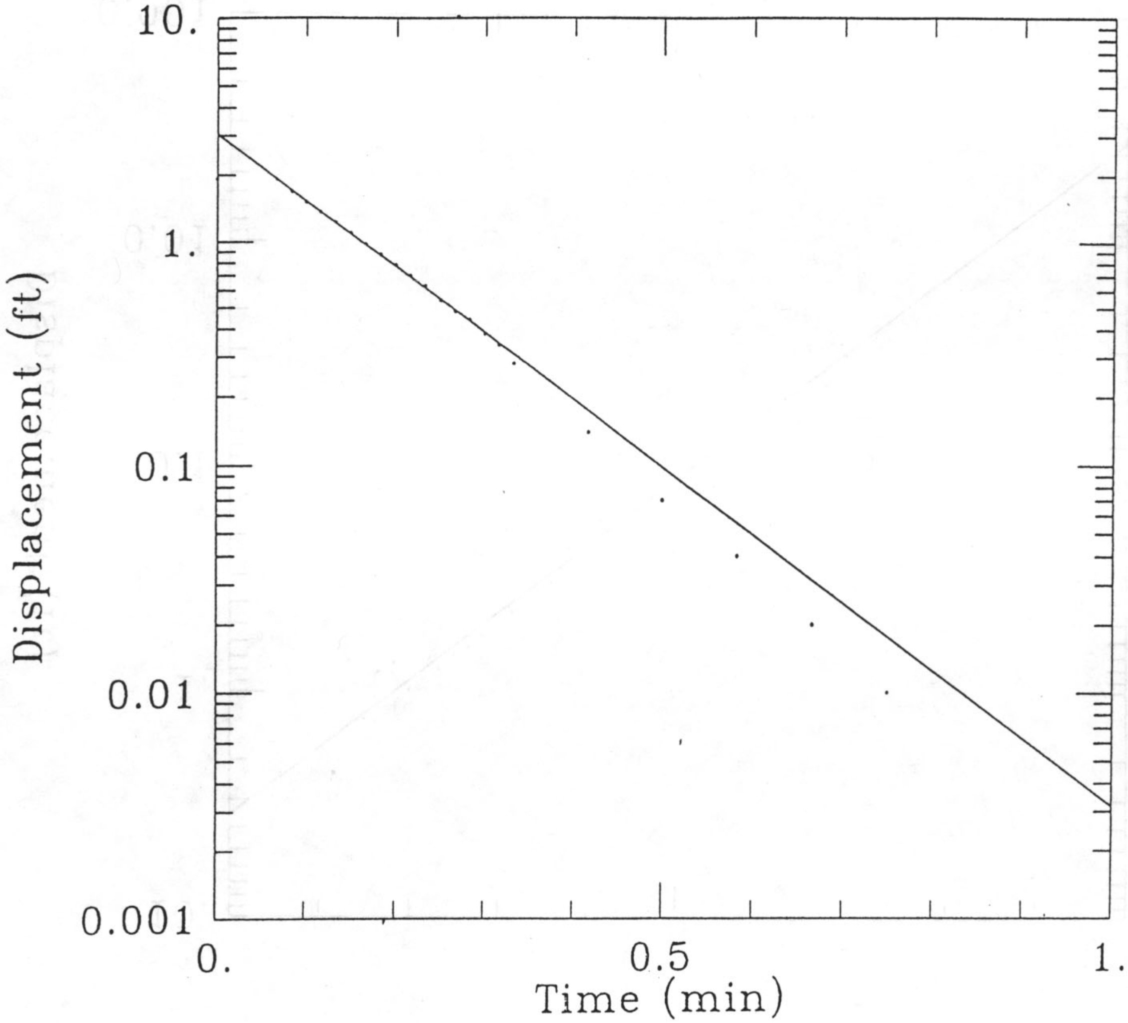
PROJECT DATA:
test date: 8/9/95

TEST DATA:
H0 = 2.27 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 36. ft
H = 11. ft

PARAMETER ESTIMATES:
K = 0.01977 ft/min
y0 = 3.505 ft

AQTESOLV

0004Z6
JU 12/19/97



DATA SET:
P24SSO.DAT MW-30S
09/21/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/9/95

TEST DATA:
H0 = 1.92 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 36. ft
H = 11. ft

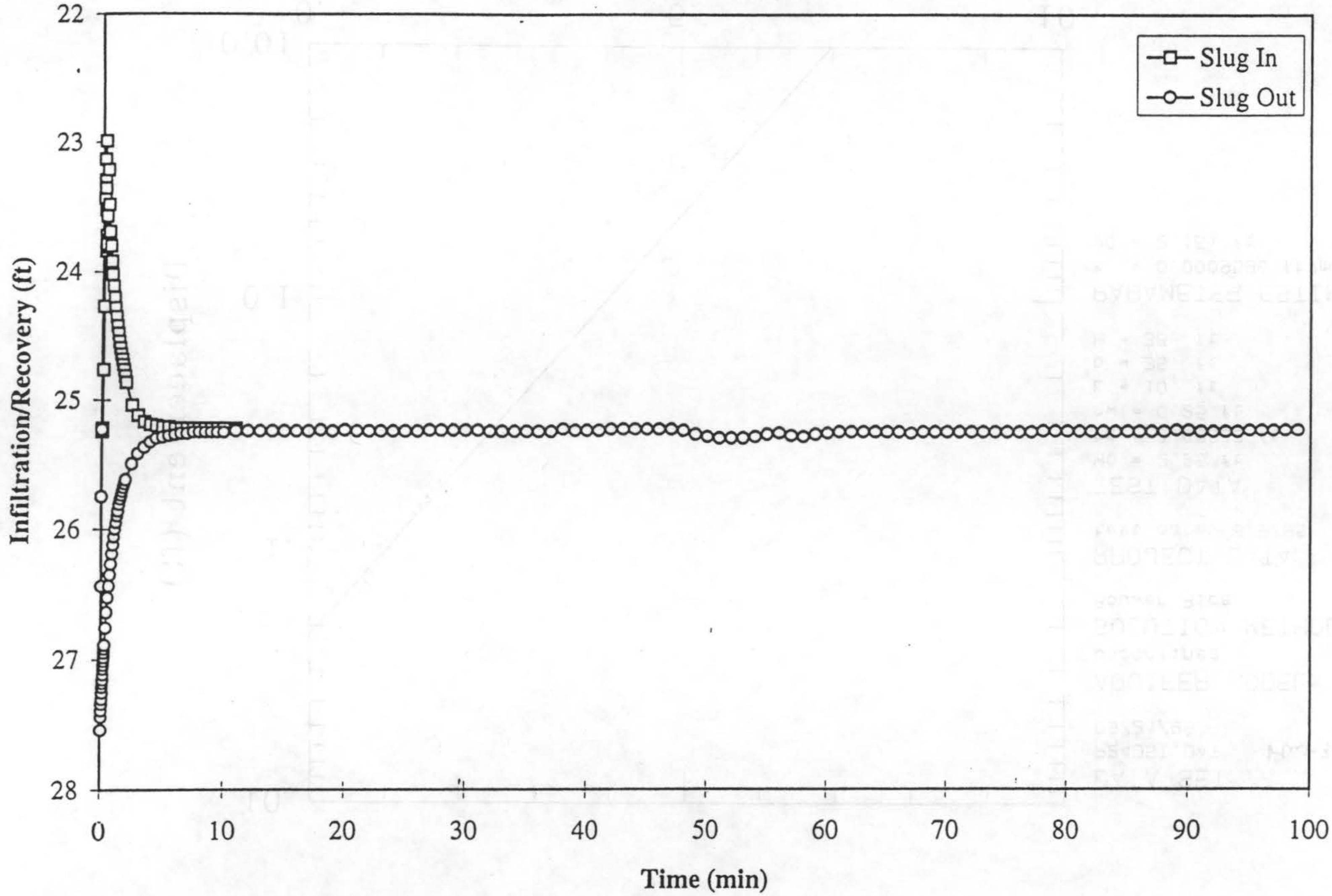
PARAMETER ESTIMATES:
K = 0.01973 ft/min
y0 = 3.044 ft

AQTESOLV

000427

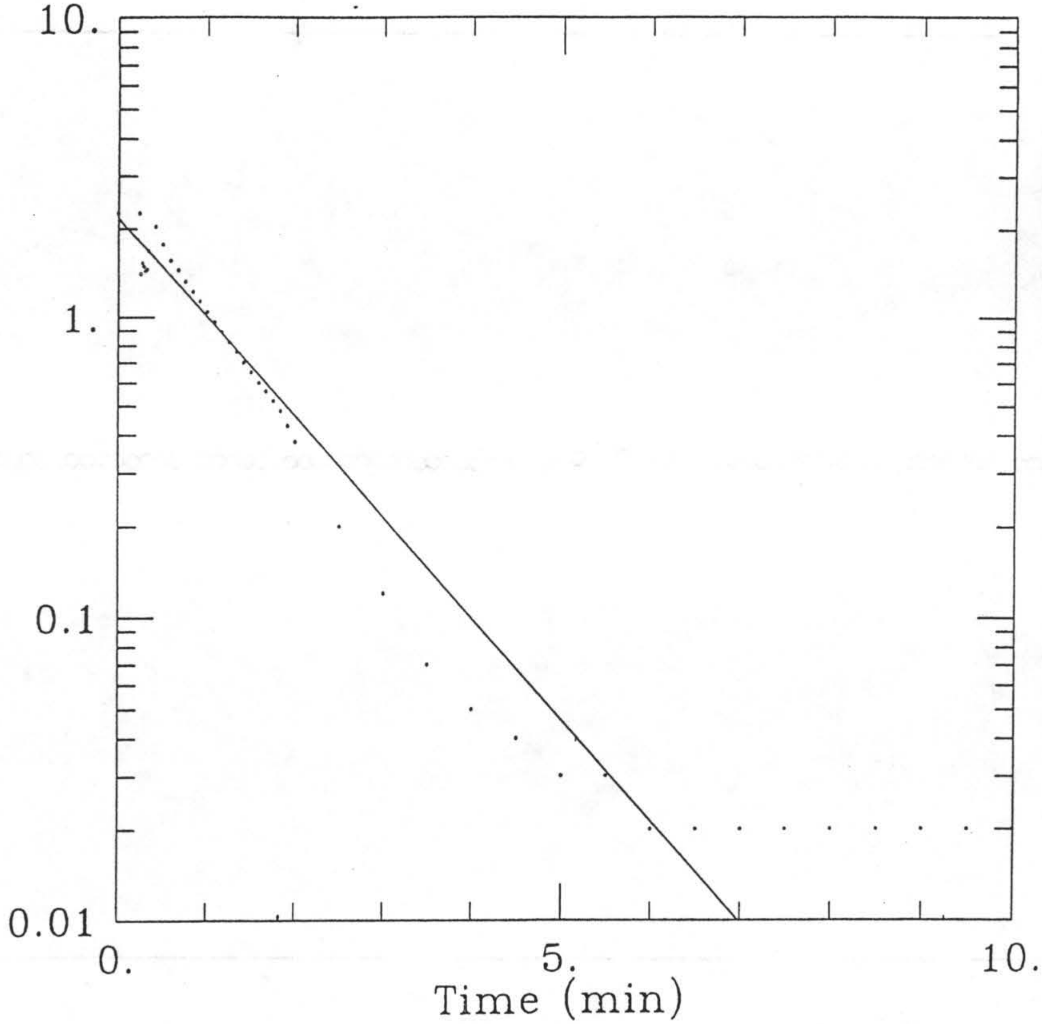
MW-30D (JH) 12/19/97

~~P-24D~~ Slug Test



~~0004258~~
JH 12/19/97

000429



DATA SET:
P24DSI.DAT MW-30D
09/21/95

AQUIFER MODEL:
Unconfined

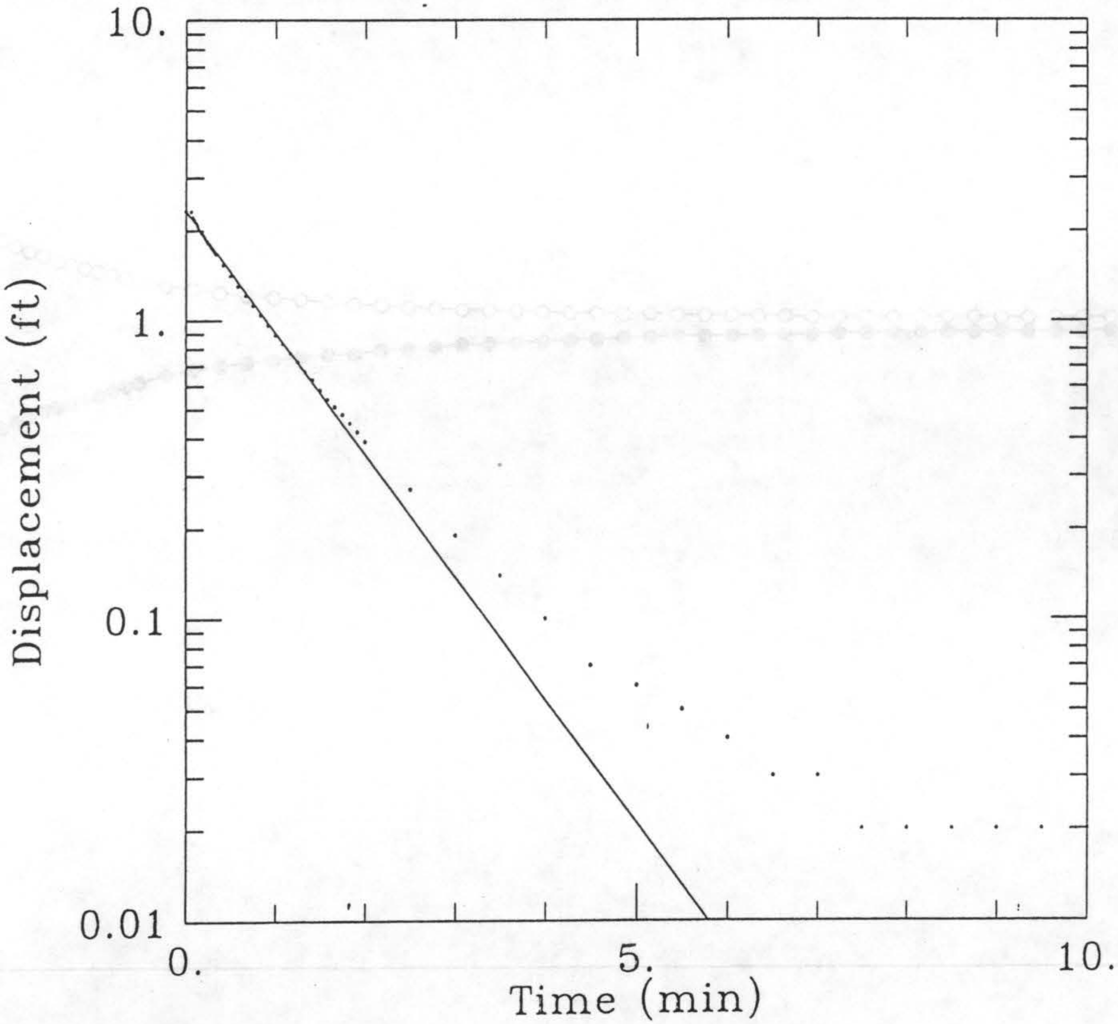
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/9/95

TEST DATA:
H0 = 2.25 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 36. ft
H = 36. ft

PARAMETER ESTIMATES:
K = 0.0009596 ft/min
y0 = 2.161 ft

AQTESOLV



DATA SET:
P24DSO.DAT MW-30D
09/21/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/9/95

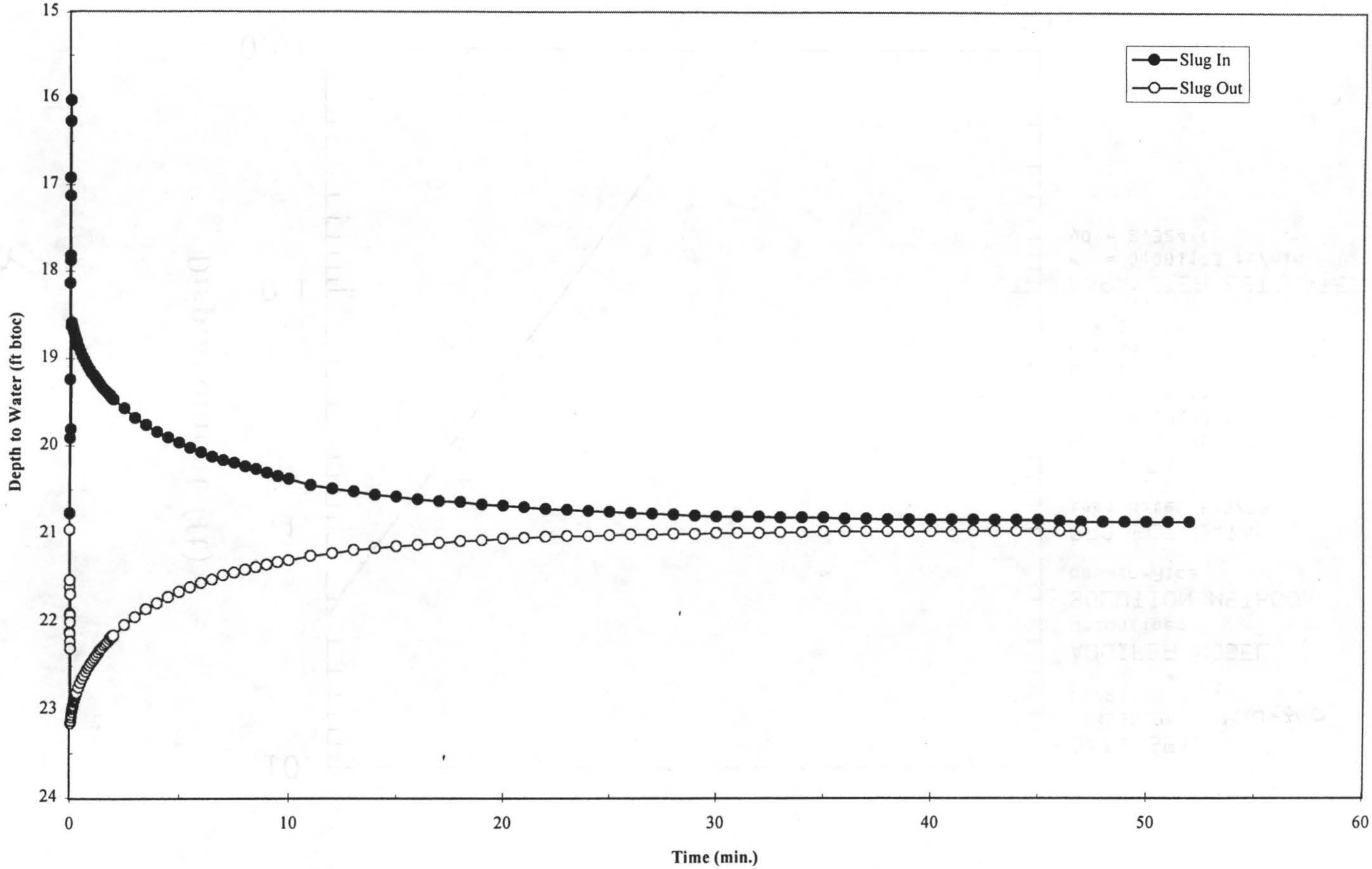
TEST DATA:
H0 = 2.31 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 36. ft
H = 36. ft

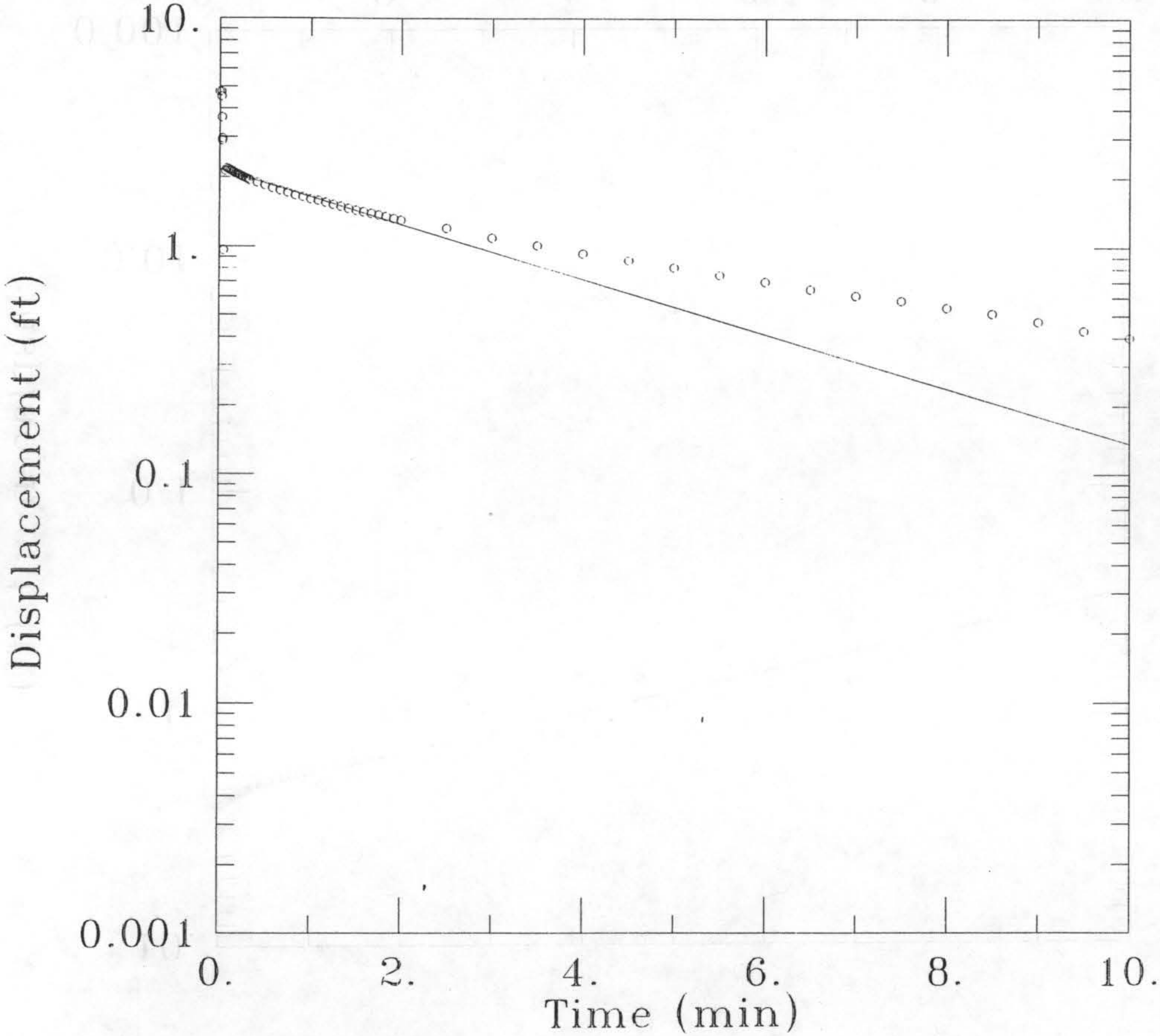
PARAMETER ESTIMATES:
K = 0.001173 ft/min
y0 = 2.324 ft

AQTESOLV

0004130
JH 12/15/97

MW-31 Aquifer Tests





DATA SET:
MW31SI.DAT
10/23/97

AQUIFER MODEL:
Unconfined

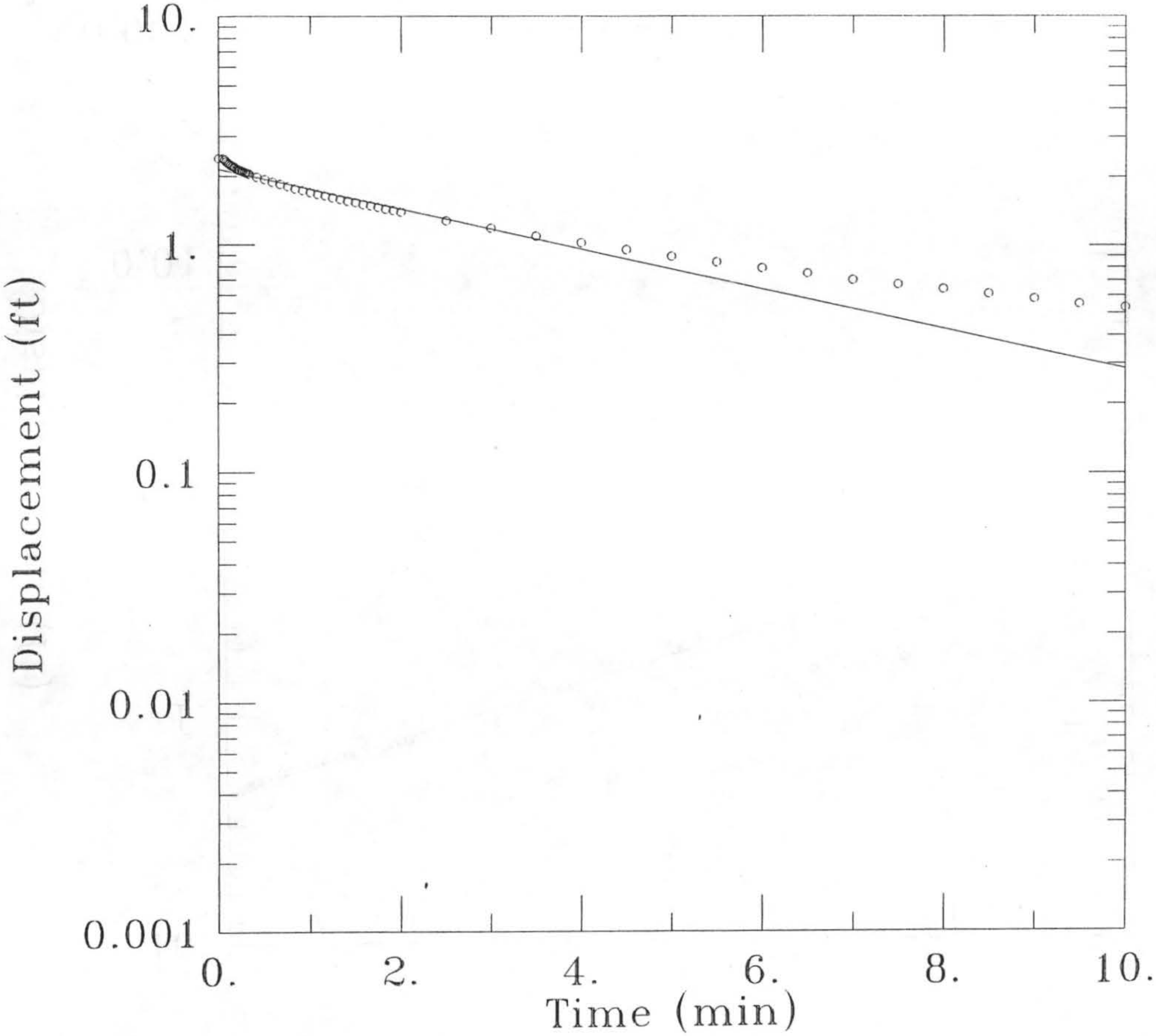
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/17/97

TEST DATA:
H0 = 4.74 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 28.53 ft
H = 28.53 ft

PARAMETER ESTIMATES:
K = 0.000331 ft/min
y0 = 2.163 ft

AQTESOLV



DATA SET:
MW31SO.DAT
10/23/97

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

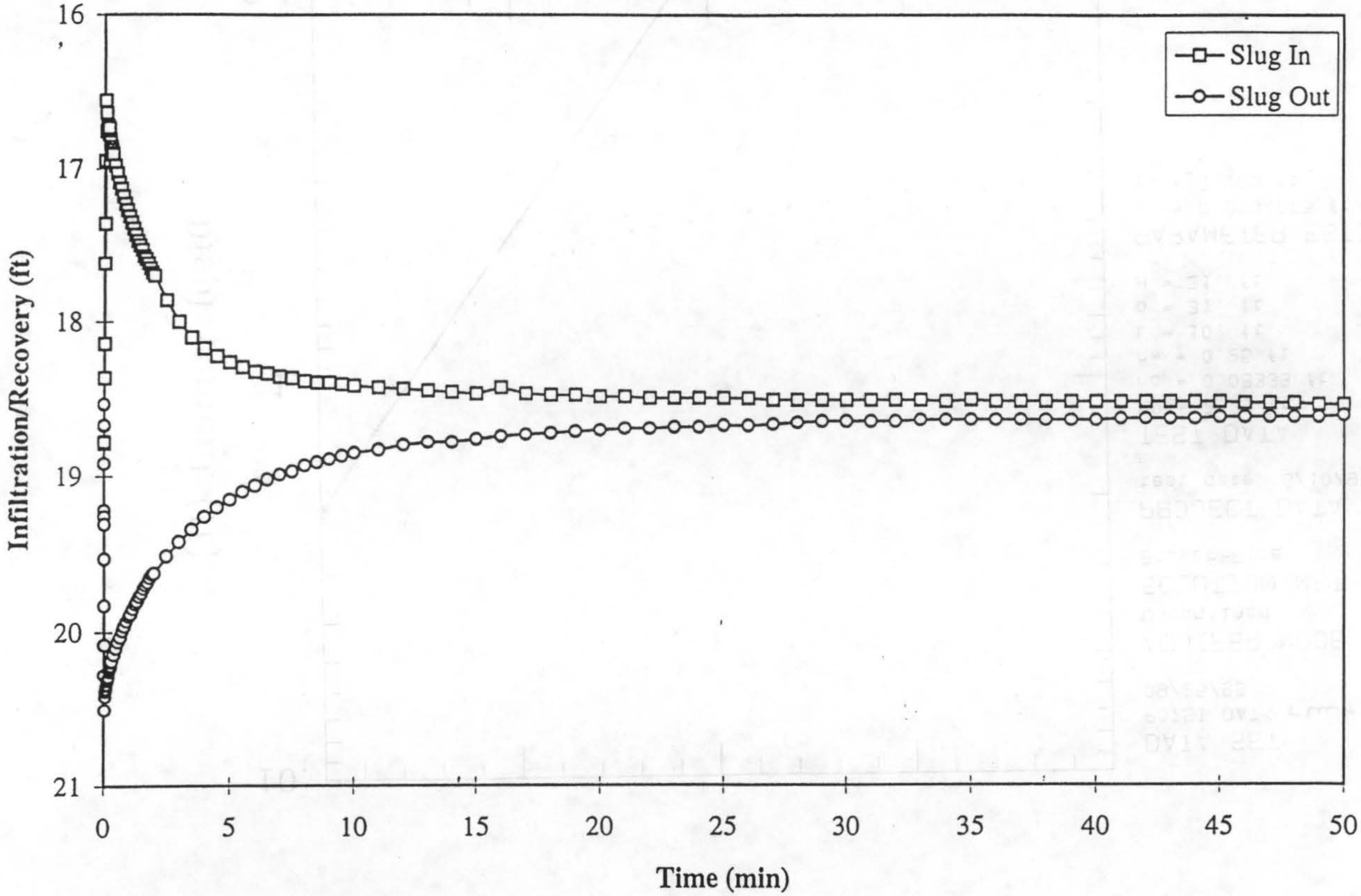
PROJECT DATA:
test date: 8/17/97

TEST DATA:
H0 = 2.39 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 28.53 ft
H = 28.53 ft

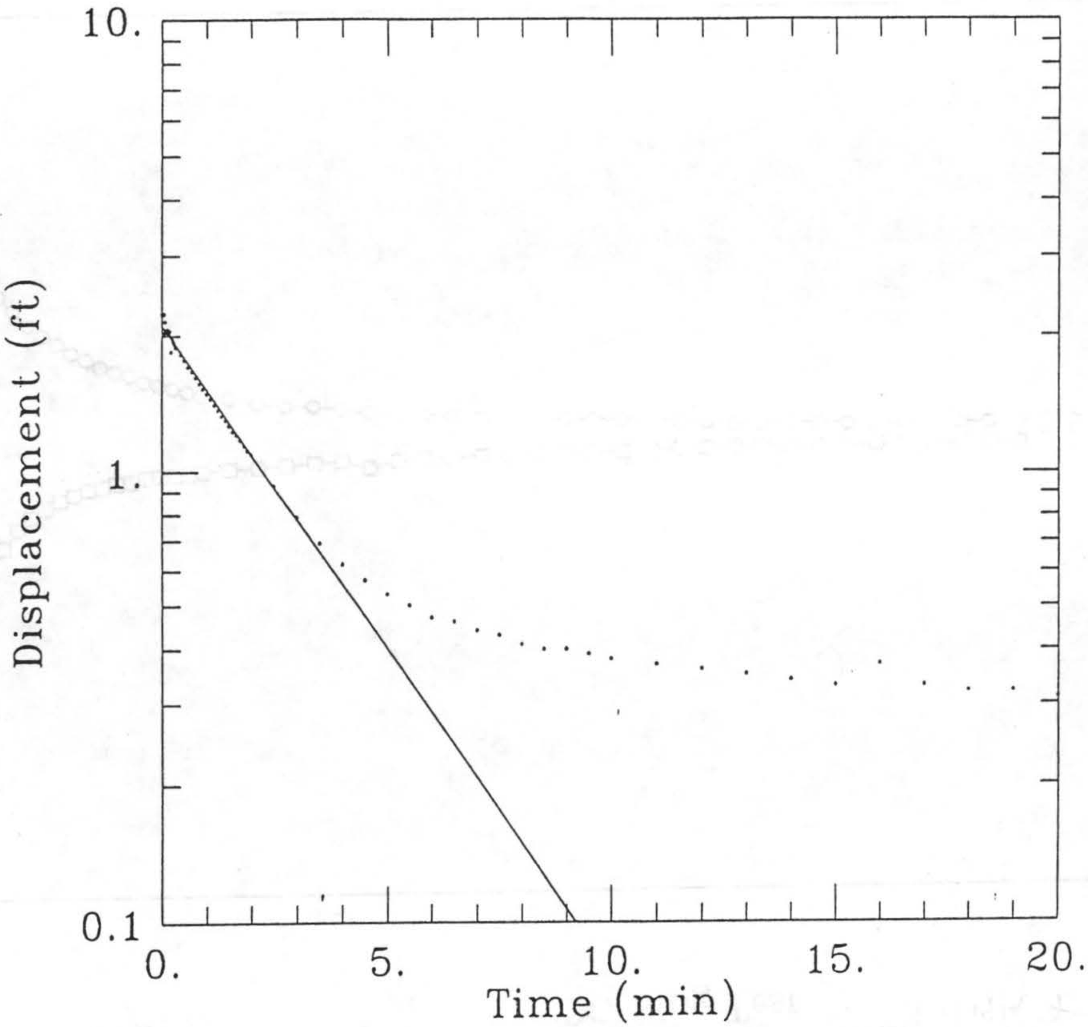
PARAMETER ESTIMATES:
K = 0.0002417 ft/min
y0 = 2.144 ft

AQTESOLV

MW-32 ~~P-7~~ Slug Test JH 12/19/97



~~000374~~
JK 12/19/97



DATA SET:
P07SI.DAT rw-32
09/25/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

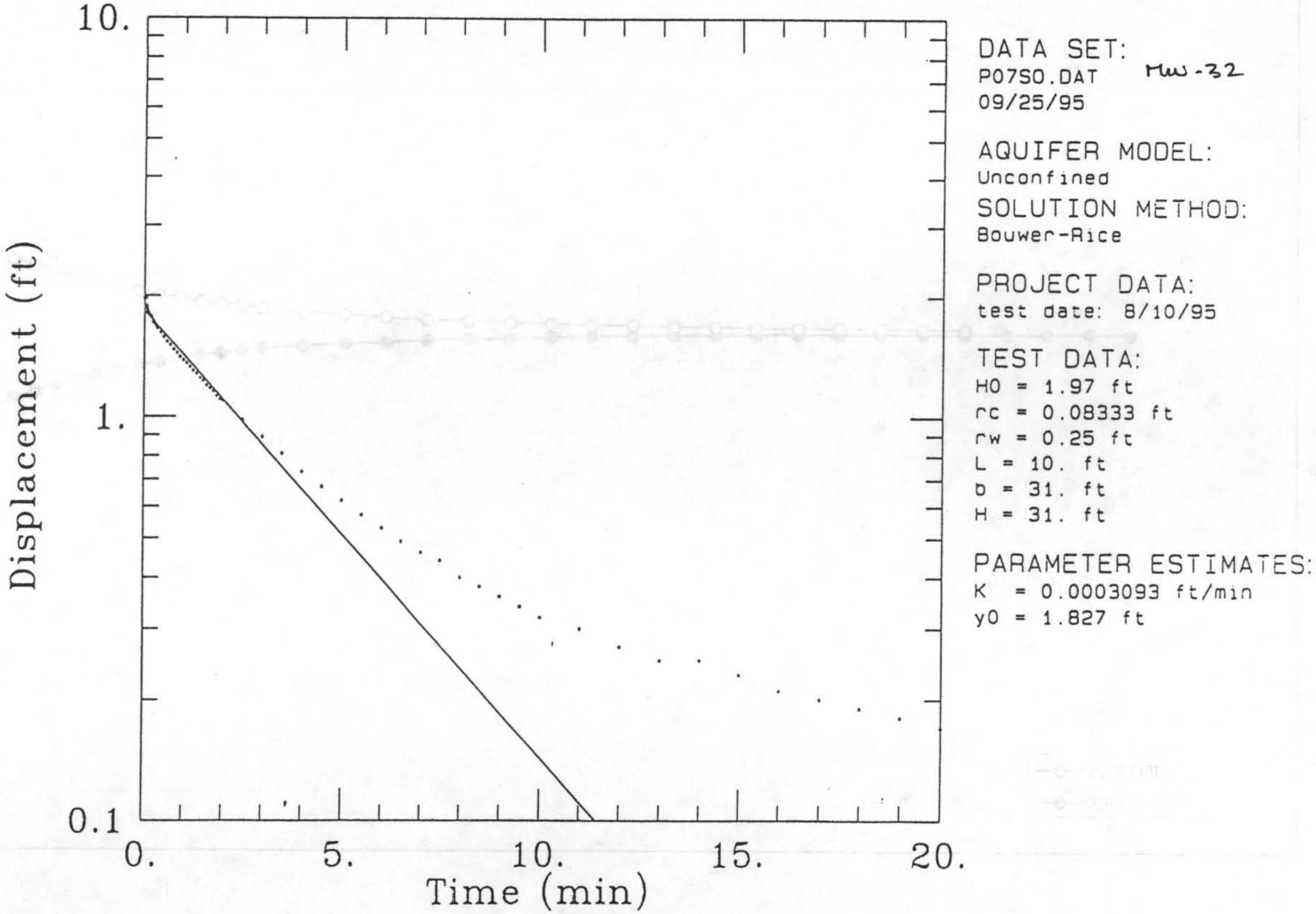
PROJECT DATA:
test date: 8/10/95

TEST DATA:
H0 = 2.23 ft
rc = 0.08333 ft
rw = 0.25 ft
L = 10. ft
b = 31. ft
H = 31. ft

PARAMETER ESTIMATES:
K = 0.0004025 ft/min
y0 = 2.106 ft

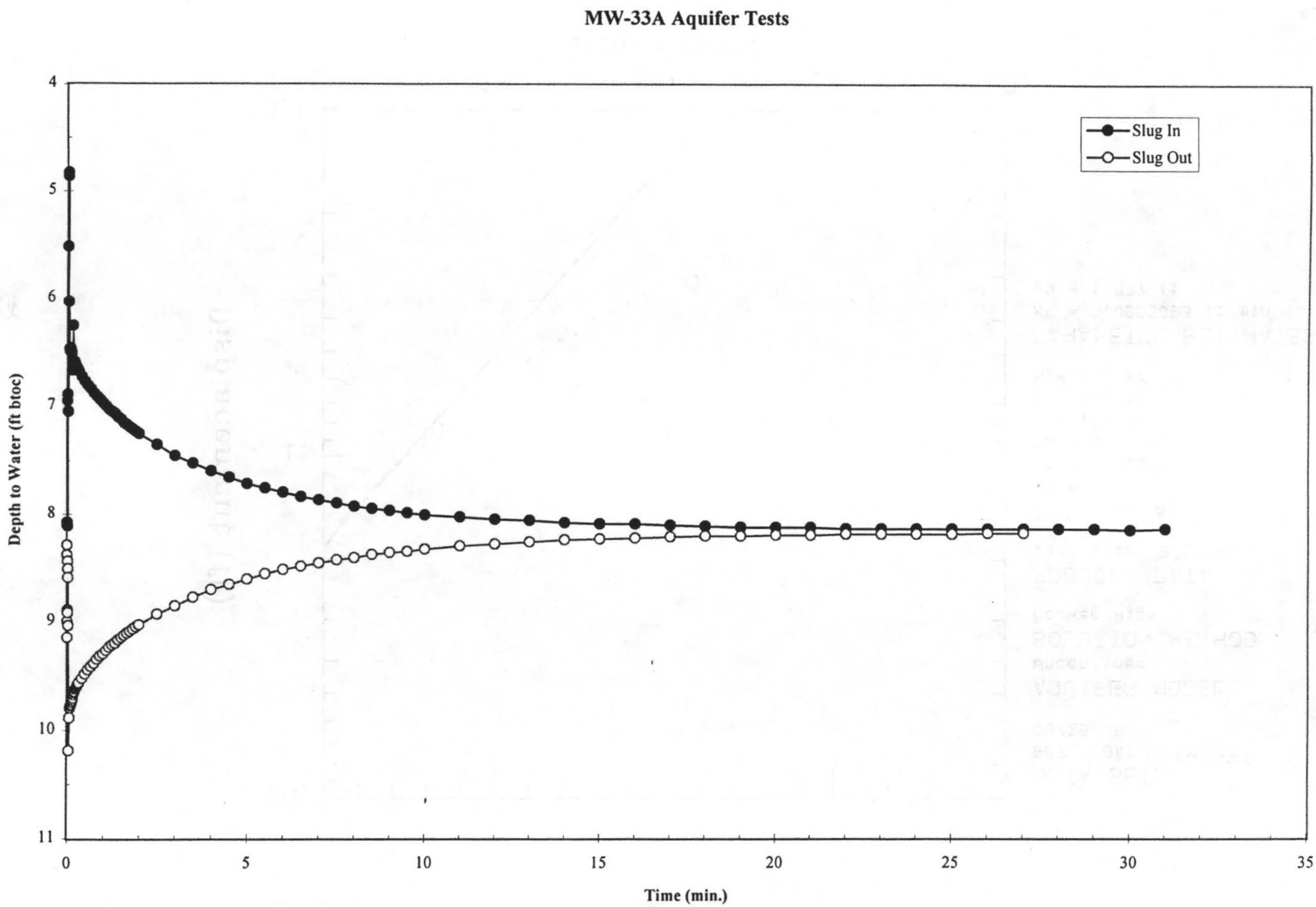
AQTESOLV

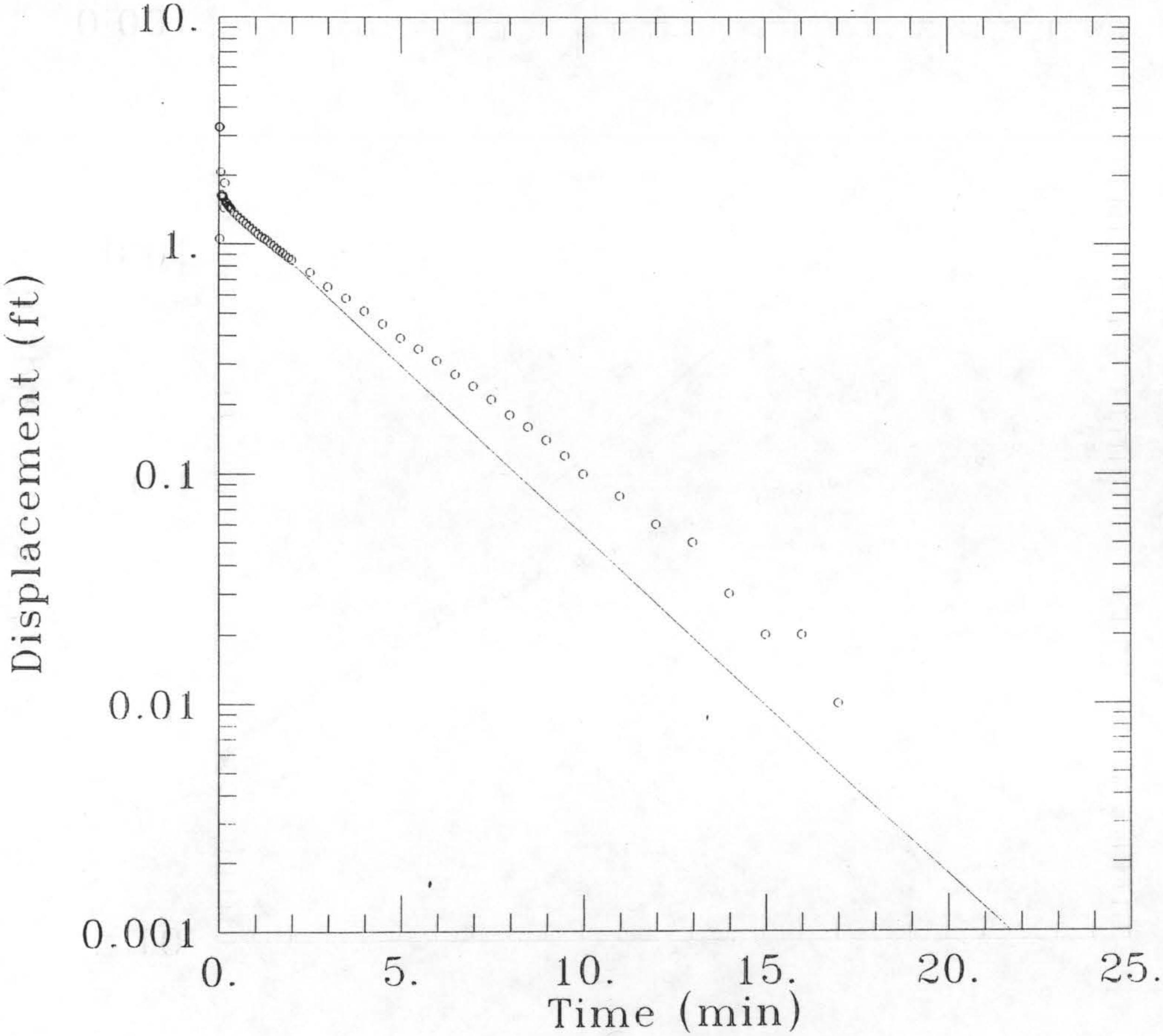
~~000375~~
(AF) 12/15/97



AQTESOLV

0003~~97~~6
12/17/92


MW-33A Aquifer Tests
Slug In
Slug Out
Depth to Water (ft btoc)
4
5
6
7
8
9
10
11
0
5
10
15
20
25
30
35
Time (min.)



DATA SET:
MW33ASI.DAT
10/23/97

AQUIFER MODEL:
Confined

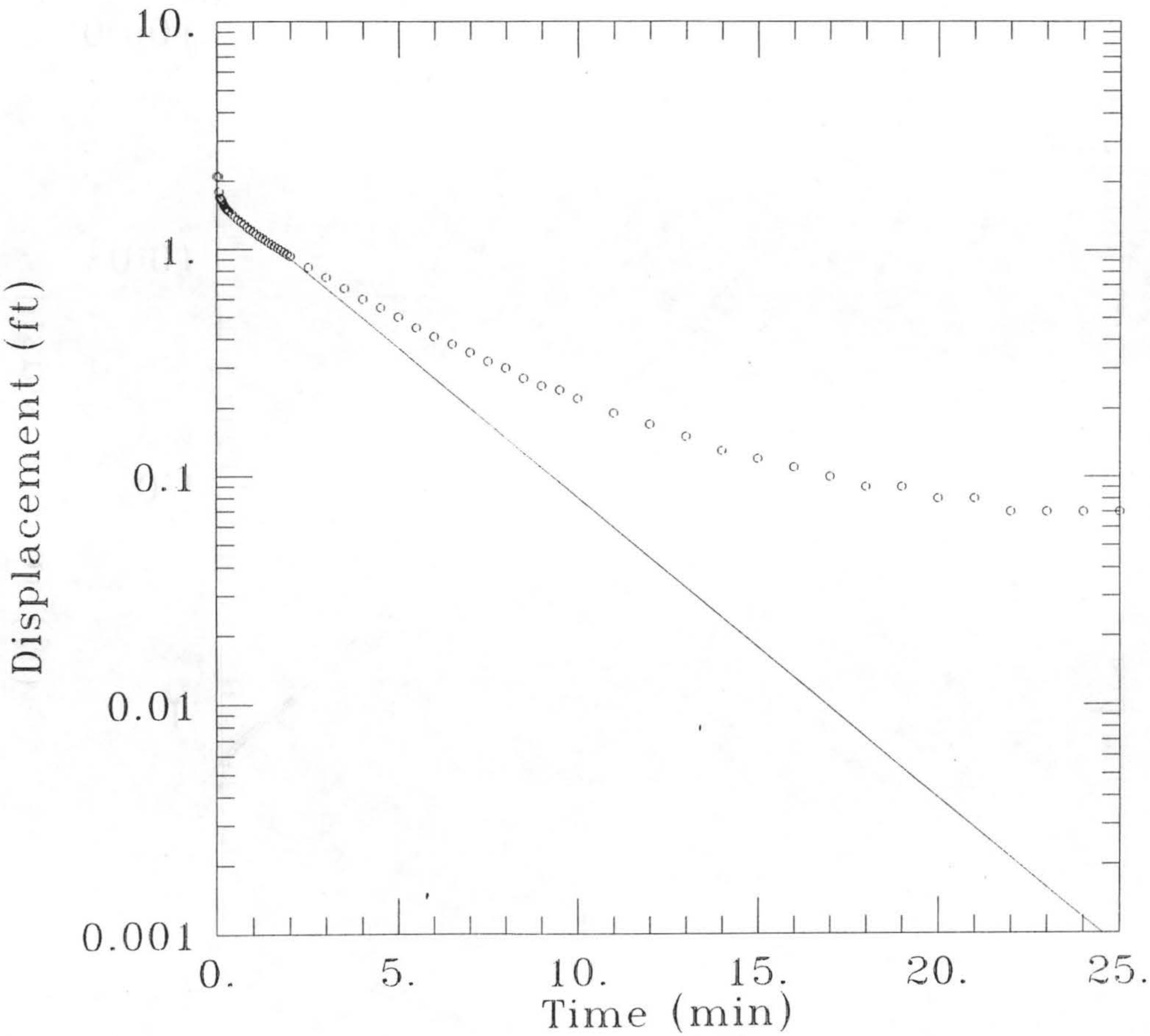
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/23/97

TEST DATA:
H0 = 3.27 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 33.33 ft
H = 33.33 ft

PARAMETER ESTIMATES:
K = 0.000419 ft/min
y0 = 1.628 ft

AQTESOLV



DATA SET:
MW33ASO.DAT
10/23/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

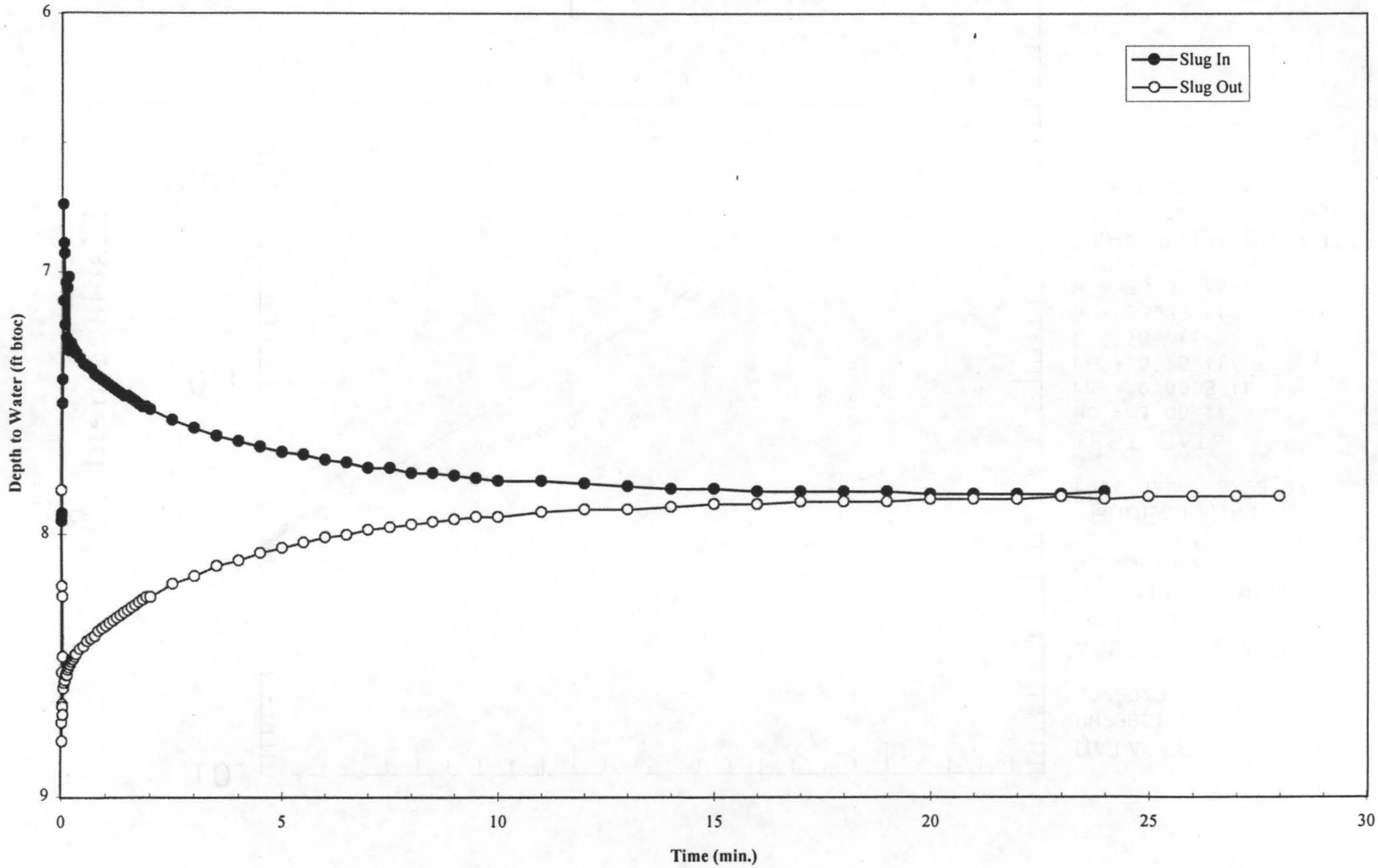
PROJECT DATA:
test date: 8/23/97

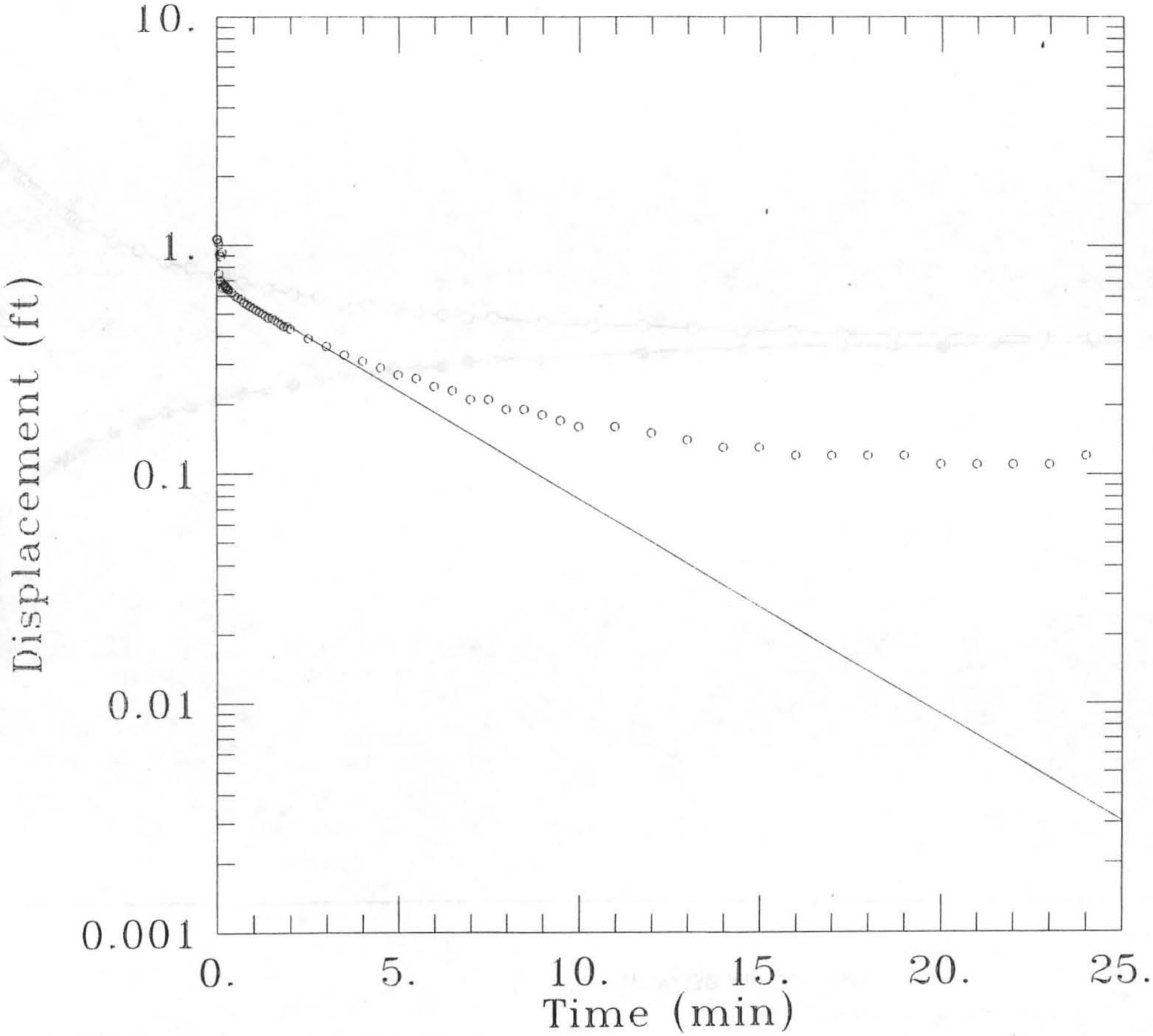
TEST DATA:
H0 = 2.09 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 33.33 ft
H = 33.33 ft

PARAMETER ESTIMATES:
K = 0.0003716 ft/min
y0 = 1.659 ft

AQTESOLV

MW-33B Aquifer Tests





DATA SET:
MW33BSI.DAT
10/23/97

AQUIFER MODEL:
Confined

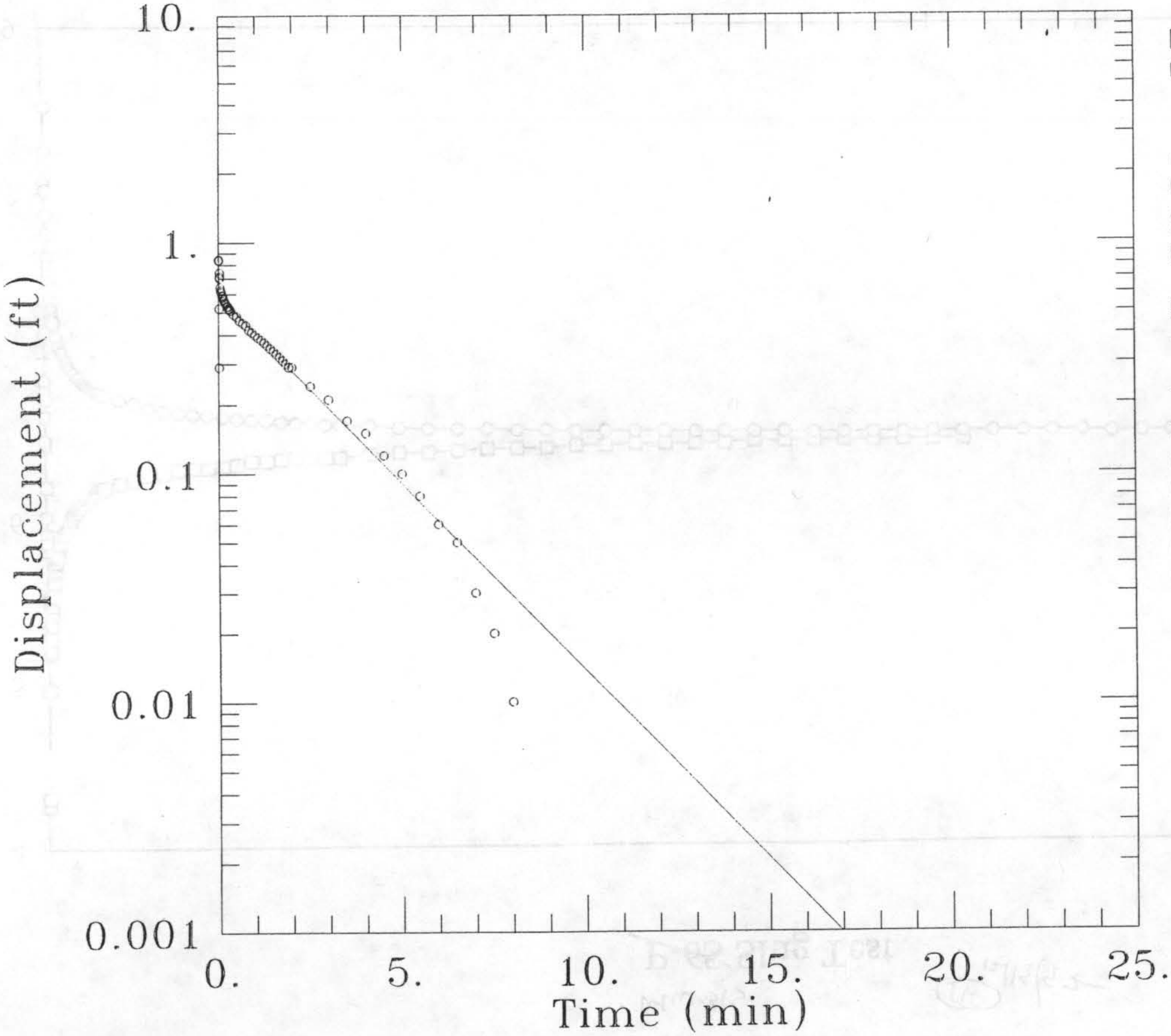
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/23/97

TEST DATA:
H0 = 1.06 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 33.33 ft
H = 33.33 ft

PARAMETER ESTIMATES:
K = 0.0002658 ft/min
y0 = 0.6769 ft

AQTESOLV



DATA SET:
MW33BSO.DAT
10/23/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/23/97

TEST DATA:
H0 = 0.84 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 33.33 ft
H = 33.33 ft

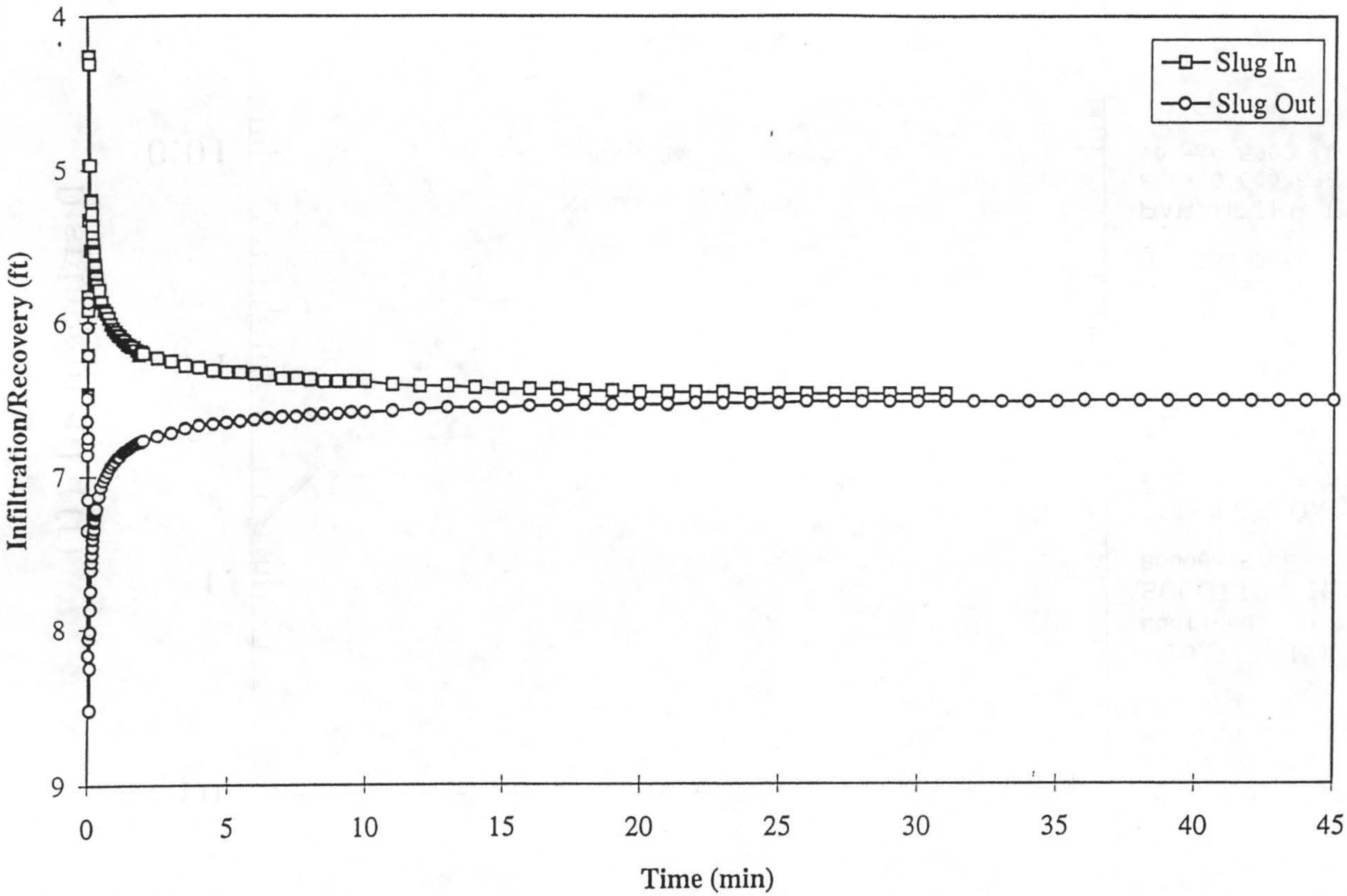
PARAMETER ESTIMATES:
K = 0.0004632 ft/min
y0 = 0.5962 ft

AQTESOLV

MW-34S

~~P-6S~~ Slug Test

JH 12/19/97

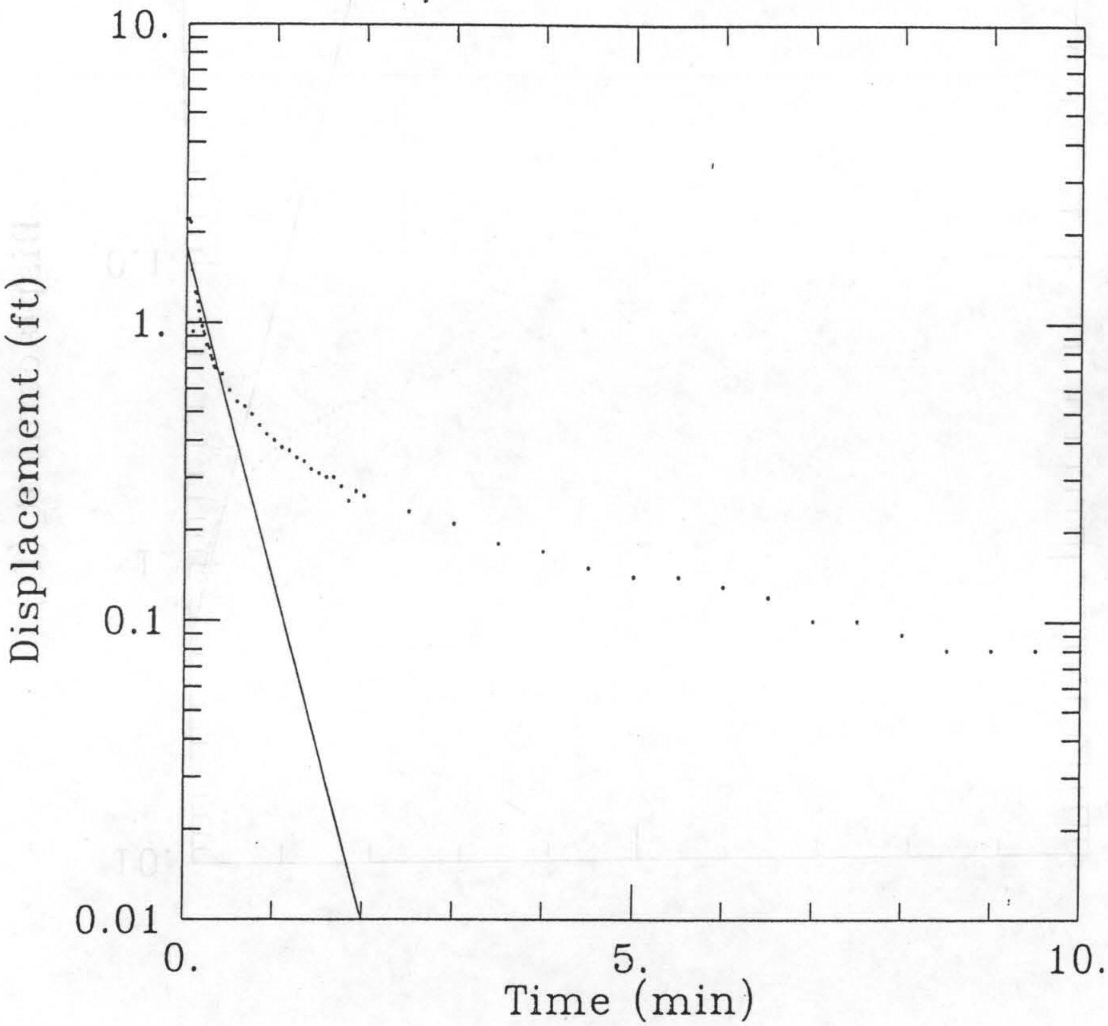


~~000368~~

JH 12/19/97

~~000369~~

JH 12/19/97



DATA SET:
P06SSIA.DAT MW-34S
09/25/95

AQUIFER MODEL:
Unconfined

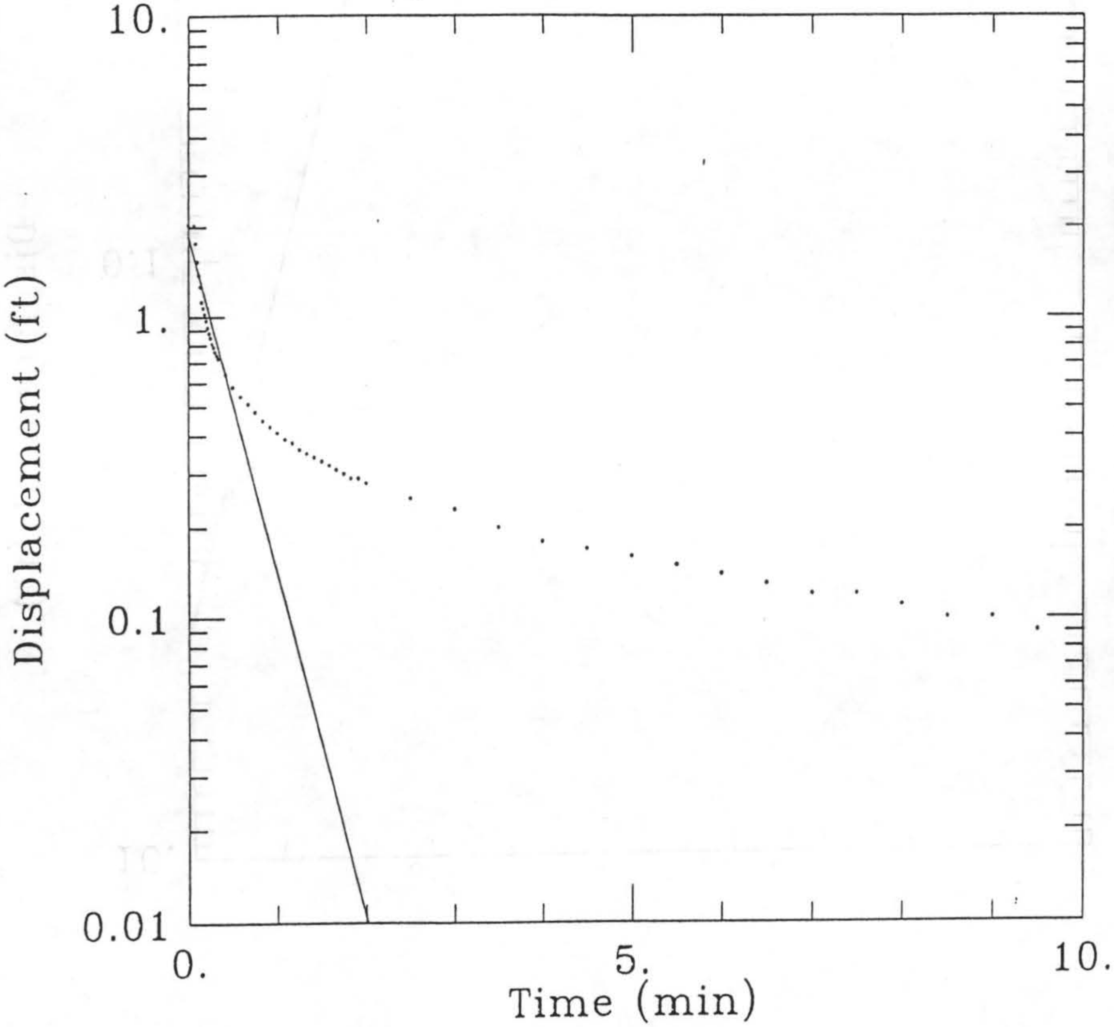
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/10/95

TEST DATA:
H0 = 2.2 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 30. ft
H = 30. ft

PARAMETER ESTIMATES:
K = 0.00314 ft/min
y0 = 1.779 ft

AQTESOLV



DATA SET:
P06SS0A.DAT
09/25/95

MW-34S

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/10/95

TEST DATA:
H0 = 2.03 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 30. ft
H = 30. ft

PARAMETER ESTIMATES:
K = 0.003127 ft/min
y0 = 1.864 ft

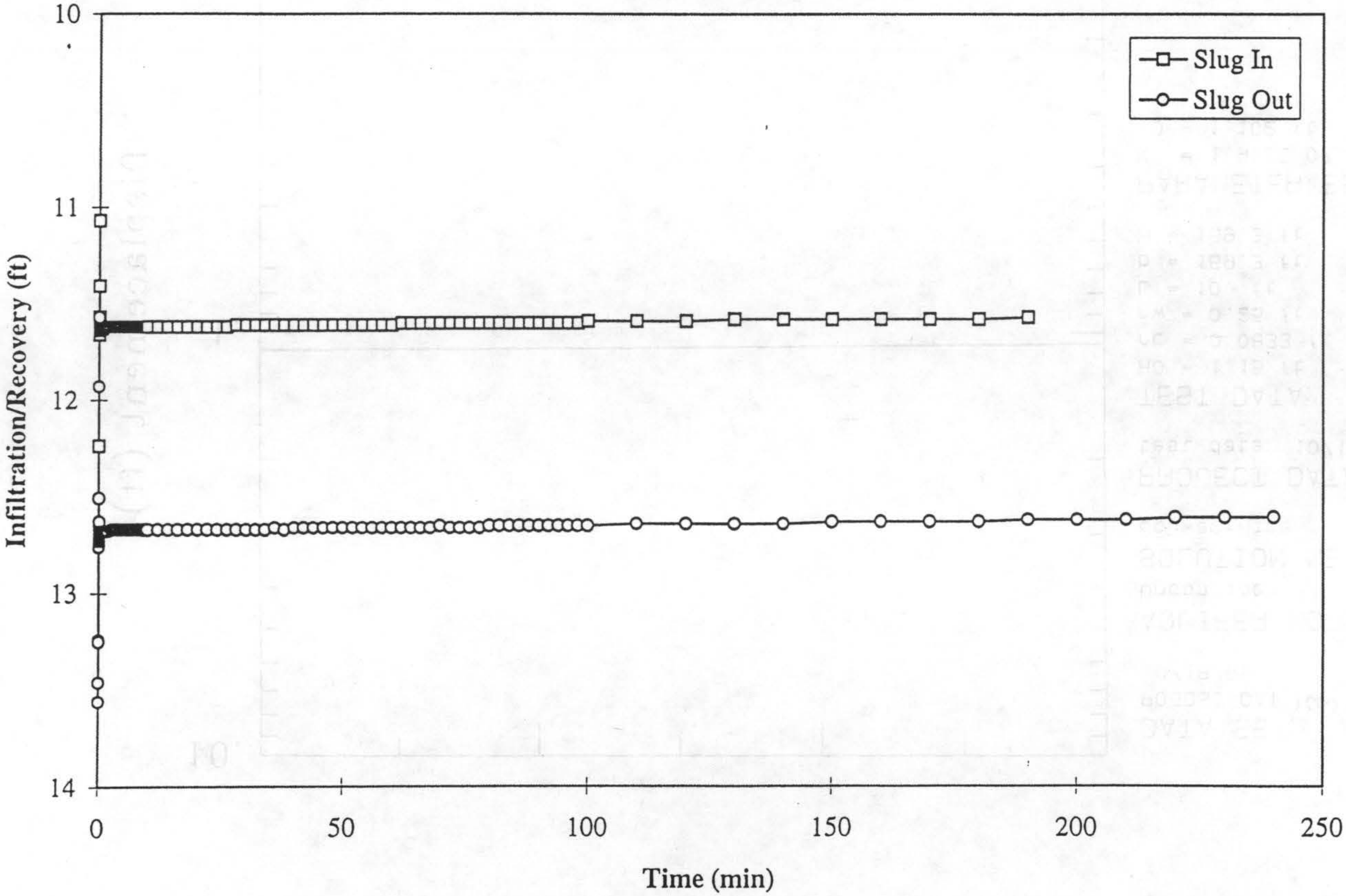
AQTESOLV

~~000~~ 0370
JLK
12/15/97

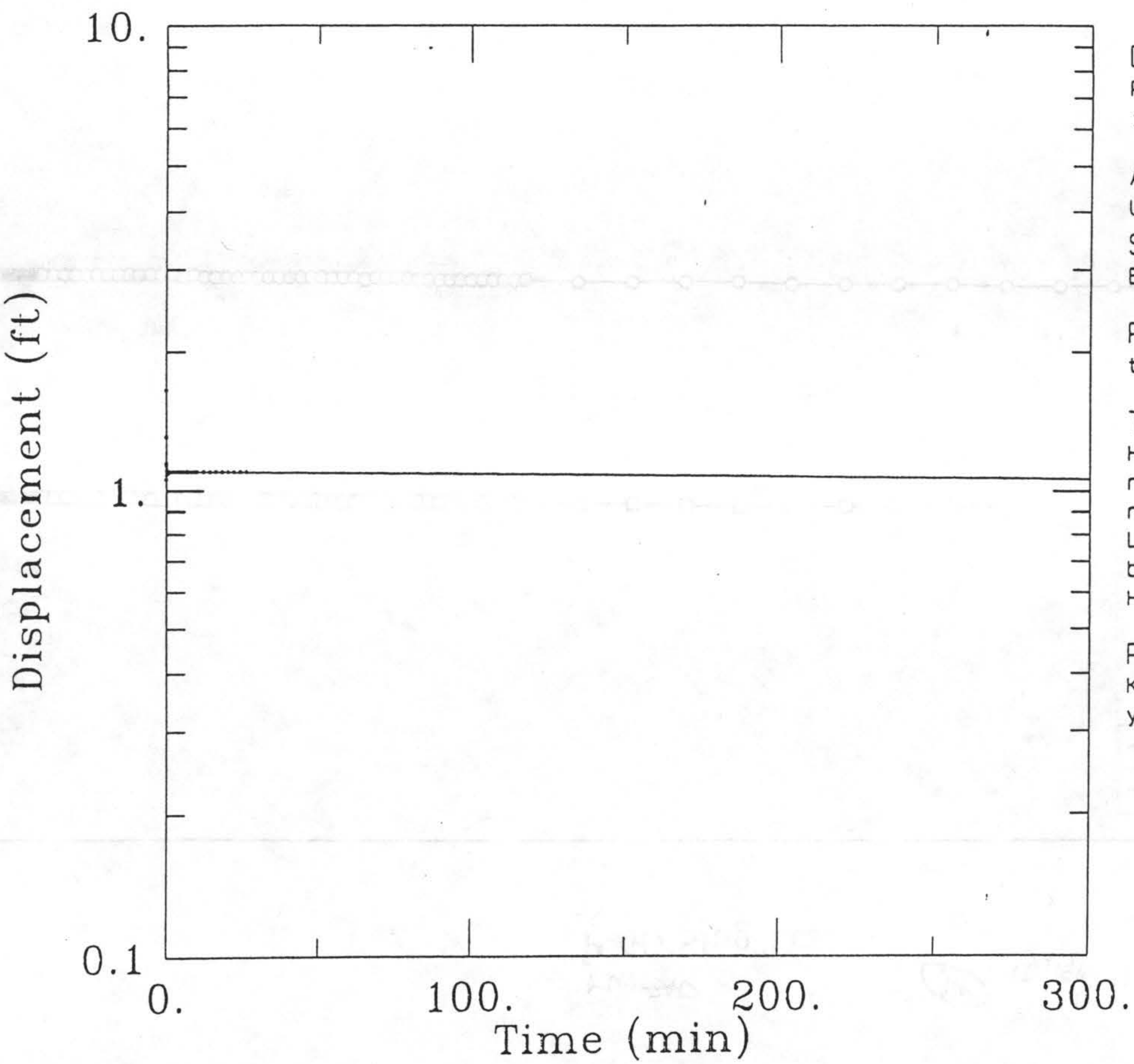
MW-34D

~~P-6D~~ Slug Test

JH 12/19/97



~~000371~~ JH 12/19/97



DATA SET:
P06DSI.DAT MW-34D
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

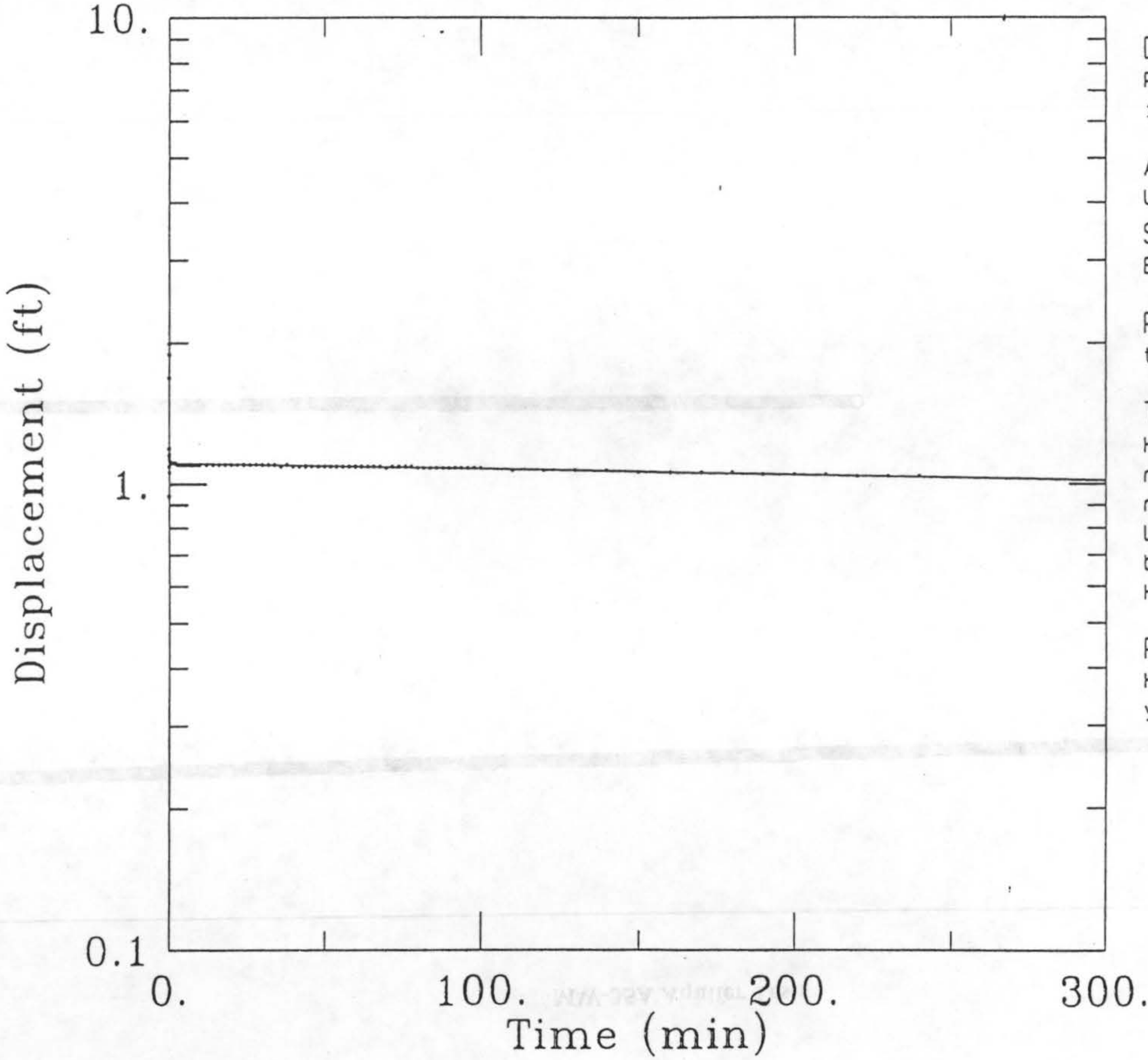
PROJECT DATA:
test date: 10/14/95

TEST DATA:
H0 = 1.15 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 169.3 ft
H = 169.3 ft

PARAMETER ESTIMATES:
K = 1.905E-07 ft/min
y0 = 1.102 ft

AQTESOLV

~~0003772~~



DATA SET:
P06DSO.DAT MW-34D
10/18/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 10/14/95

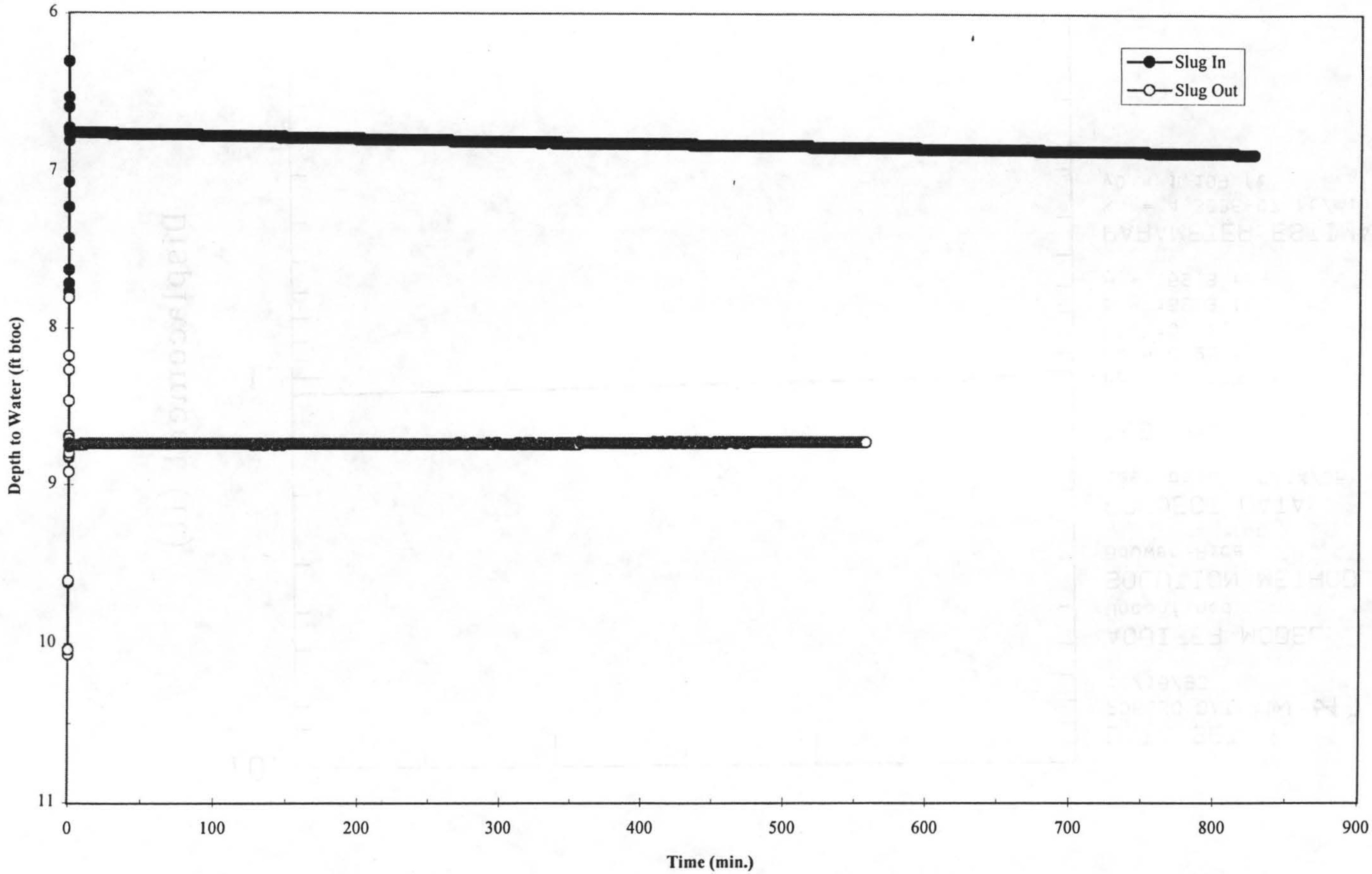
TEST DATA:
H0 = 1.19 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 169.3 ft
H = 169.3 ft

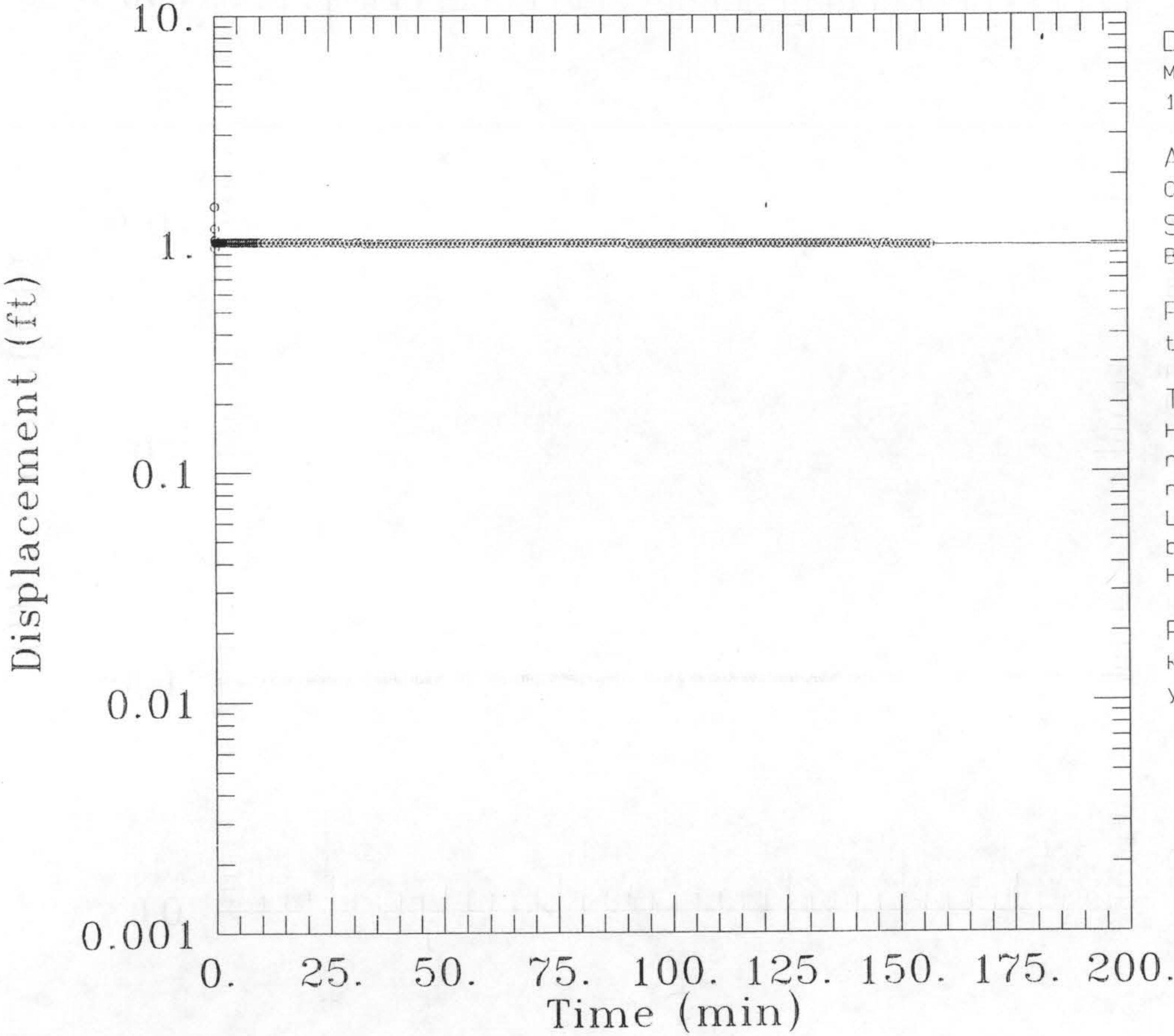
PARAMETER ESTIMATES:
K = 4.363E-07 ft/min
y0 = 1.109 ft

AQTESOLV

~~000373~~
12/19/97

MW-35A Aquifer Tests





DATA SET:
MW35SI.DAT
10/23/97

AQUIFER MODEL:
Confined

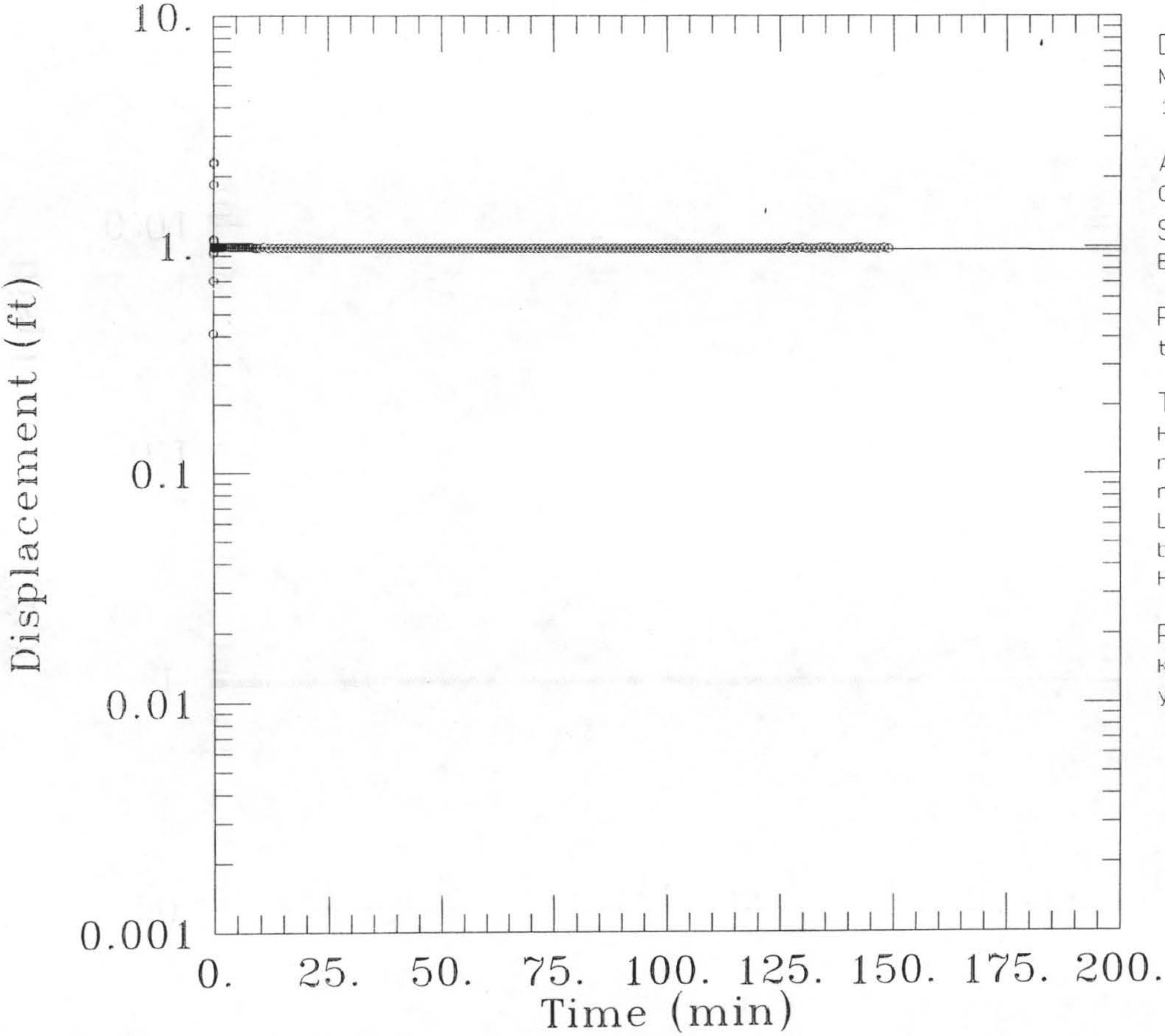
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 9/03/97

TEST DATA:
H0 = 1.46 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 24.58 ft
H = 24.58 ft

PARAMETER ESTIMATES:
K = 2.039E-07 ft/min
y0 = 1.011 ft

AQTESOLV



DATA SET:
MW35SO.DAT
10/24/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 9/04/97

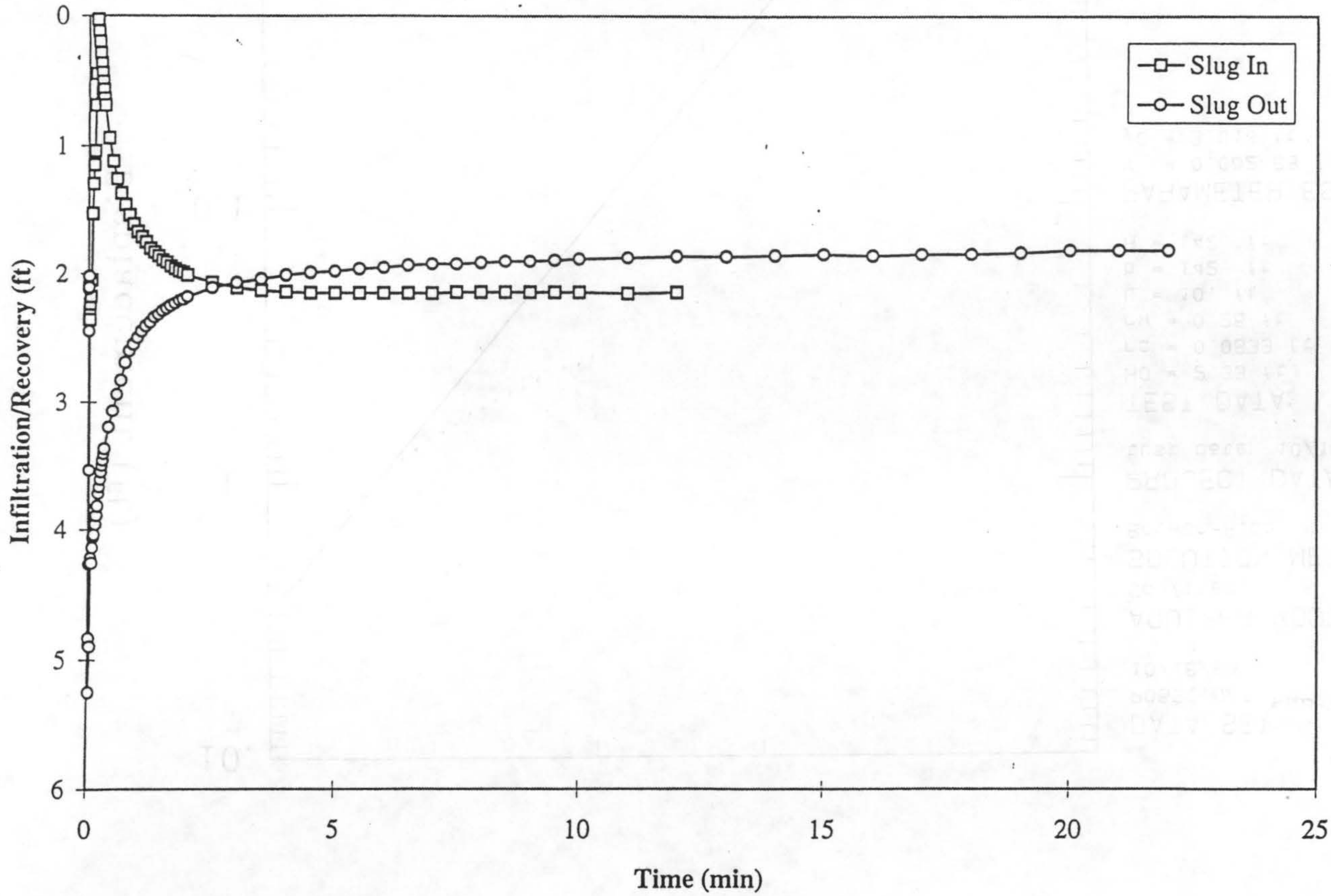
TEST DATA:
H0 = 2.3 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 24.58 ft
H = 24.58 ft

PARAMETER ESTIMATES:
K = 7.921E-08 ft/min
y0 = 0.9776 ft

AQTESOLV

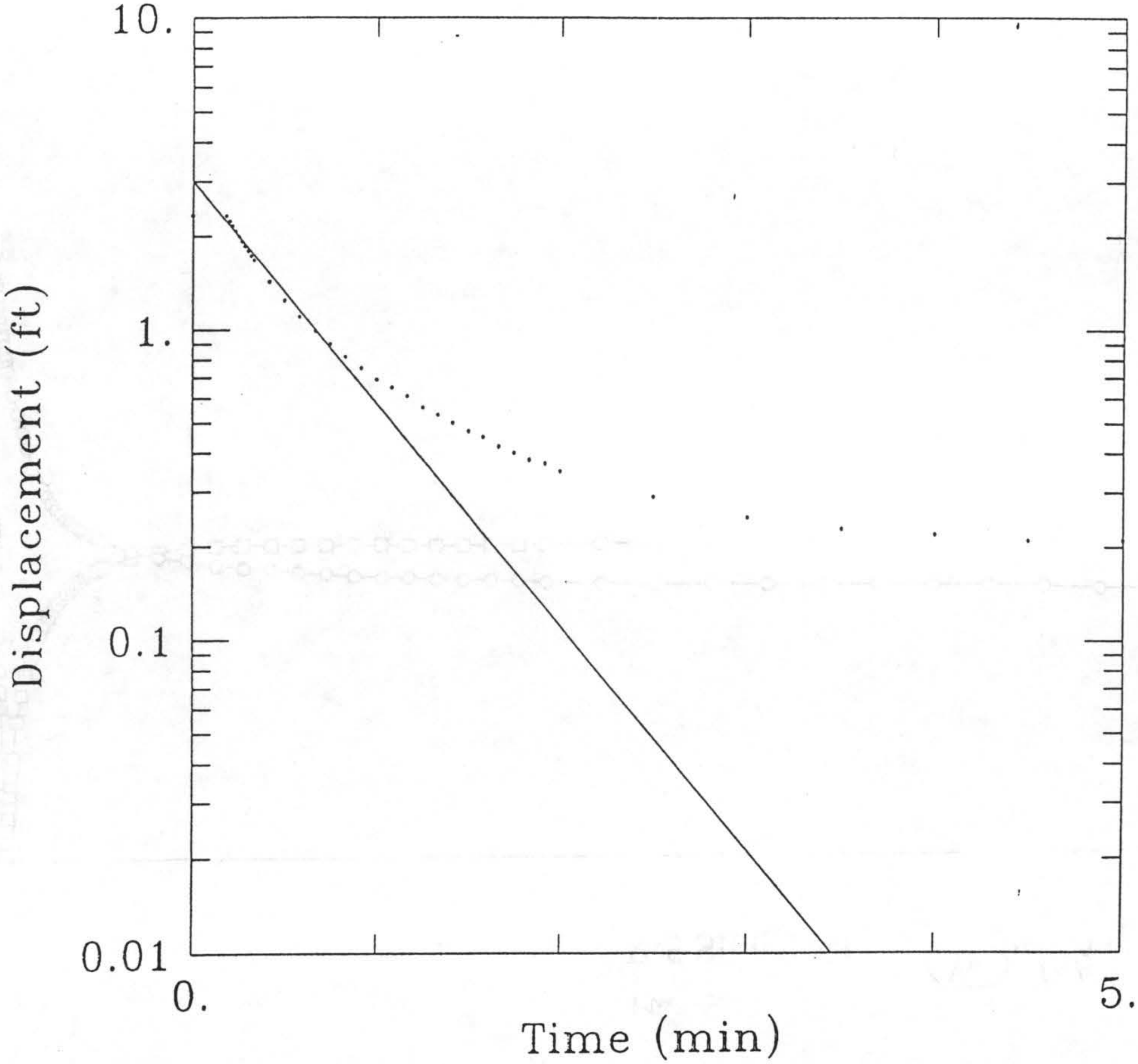
MW-36

~~P-5~~ Slug Test JH 12/19/97



000365

JH 12/19/97



DATA SET:
P05SI.DAT MW-36
10/18/95

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 10/10/95

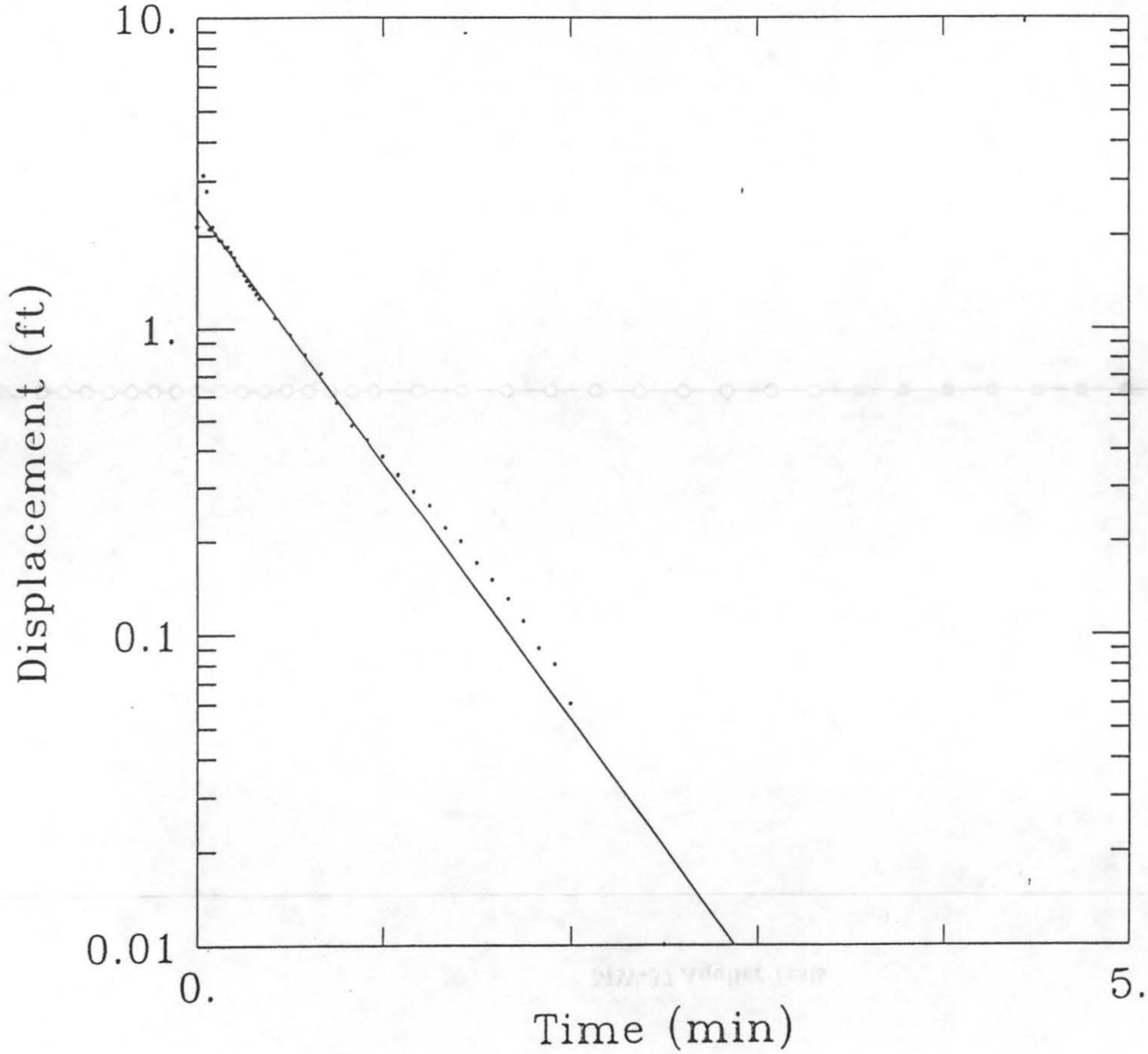
TEST DATA:
H0 = 2.33 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 142. ft
H = 142. ft

PARAMETER ESTIMATES:
K = 0.002483 ft/min
y0 = 3.013 ft

~~000366~~

12/19/97

AQTESOLV



DATA SET:
P05S0.DAT MW-36
10/18/95

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

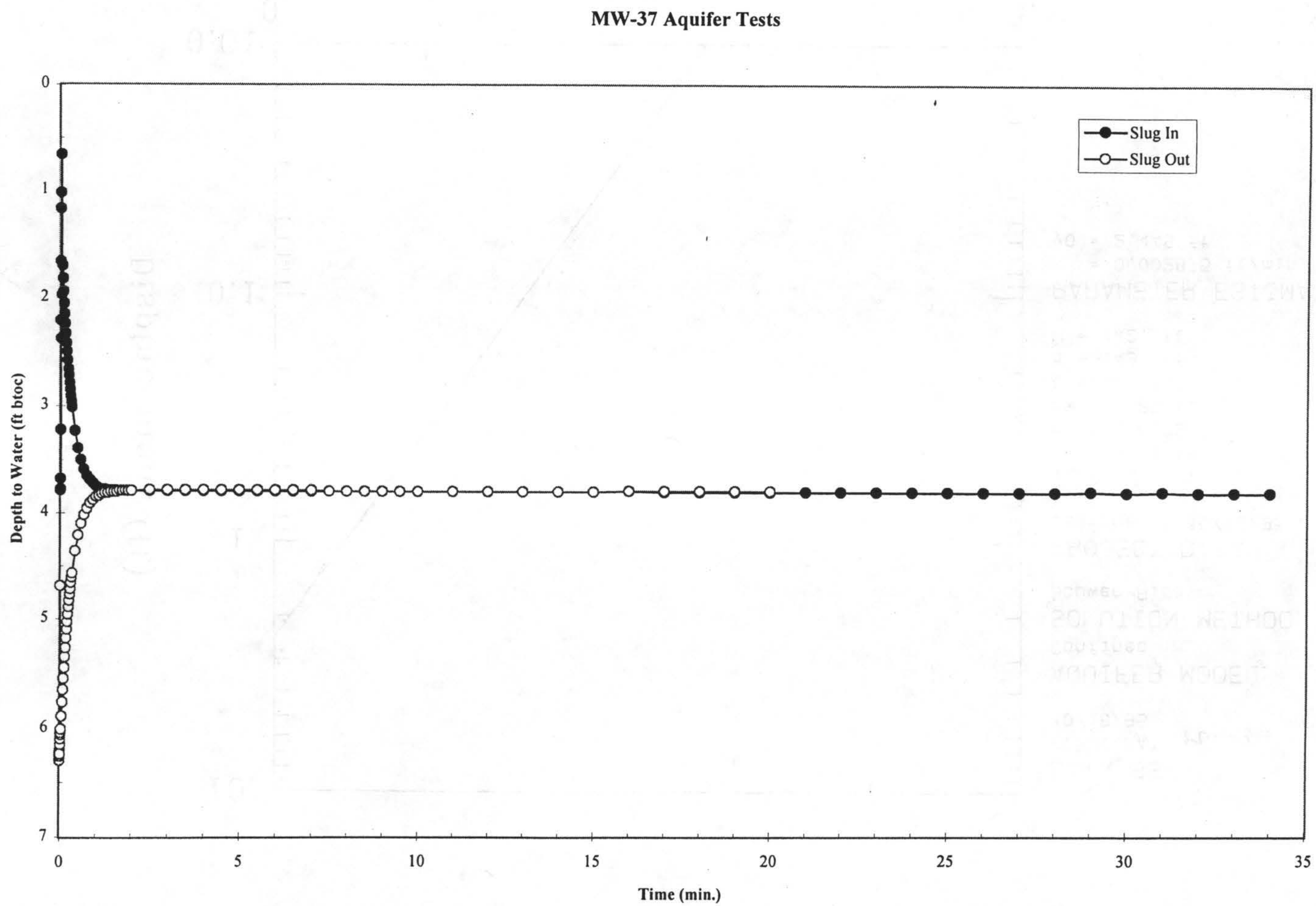
PROJECT DATA:
test date: 10/10/95

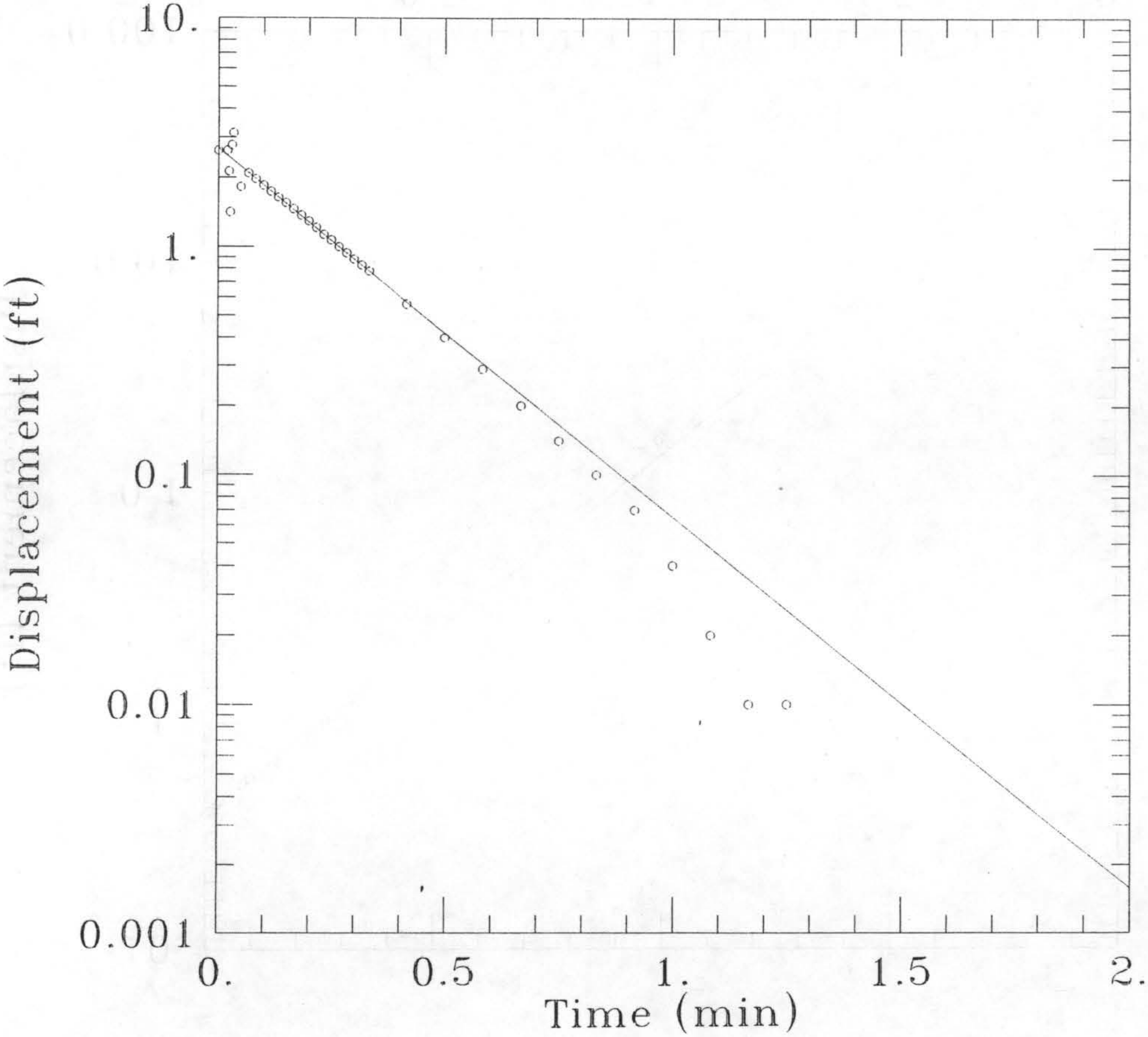
TEST DATA:
H0 = 2.14 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 142. ft
H = 142. ft

PARAMETER ESTIMATES:
K = 0.002875 ft/min
y0 = 2.448 ft

AQTESOLV

~~000367~~ JLL 12/19/97


MW-37 Aquifer Tests
Slug In
Slug Out
Depth to Water (ft btoc)
Time (min.)
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35



DATA SET:
MW37SI.DAT
10/24/97

AQUIFER MODEL:
Confined

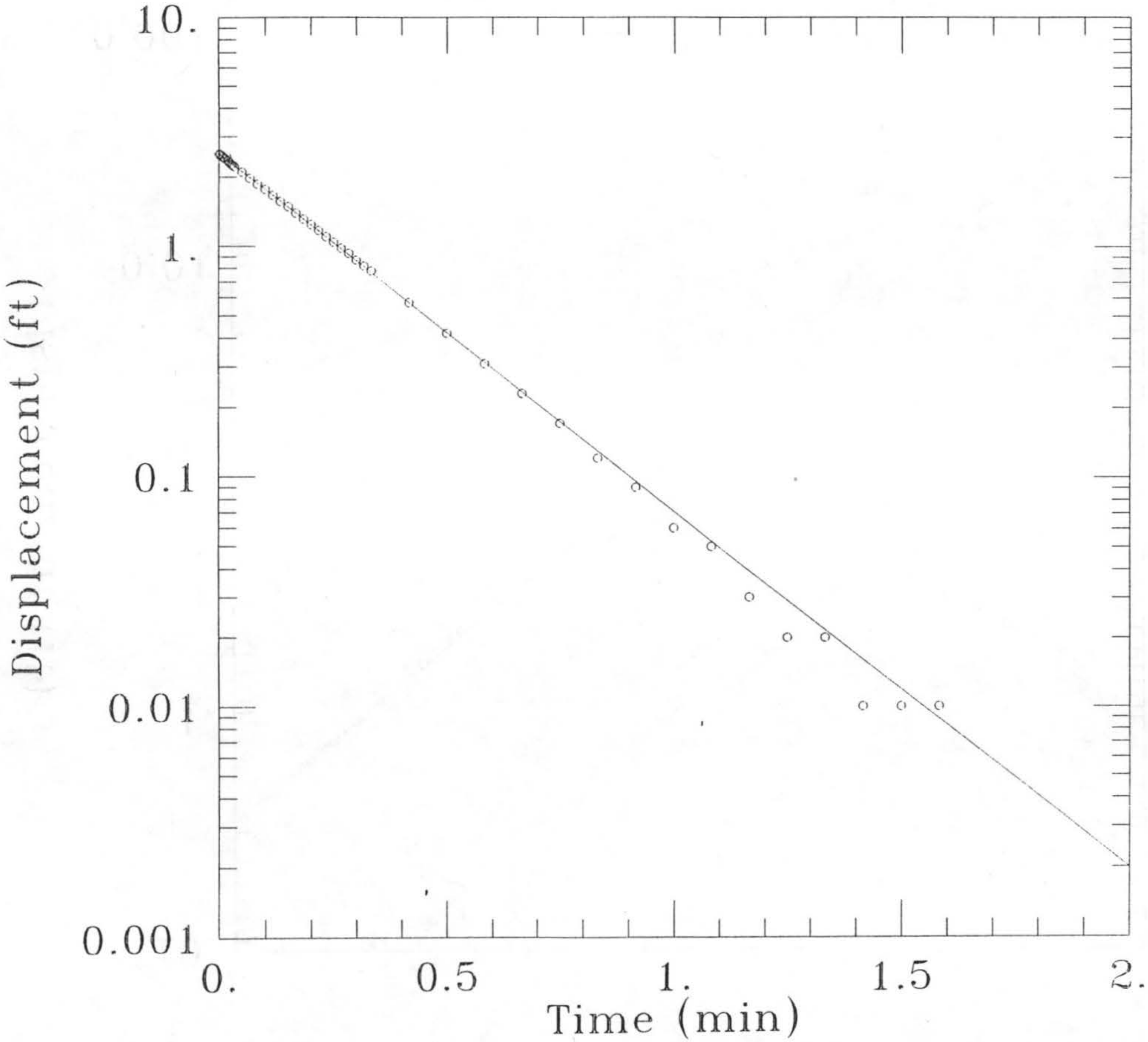
SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/16/97

TEST DATA:
H0 = 2.62 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 26.41 ft
H = 26.41 ft

PARAMETER ESTIMATES:
K = 0.0044 ft/min
y0 = 2.693 ft

AQTESOLV



DATA SET:
MW37SO.DAT
10/24/97

AQUIFER MODEL:
Confined

SOLUTION METHOD:
Bouwer-Rice

PROJECT DATA:
test date: 8/16/97

TEST DATA:
H0 = 2.51 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 26.41 ft
H = 26.41 ft

PARAMETER ESTIMATES:
K = 0.004223 ft/min
y0 = 2.525 ft

AQTESOLV

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/23/97 14:21:57

==

TEST DESCRIPTION

Data set........... MW21SI.DAT
Output file........ MW21SI.OUT
Data set title..... MW-21 SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/17/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 1.77
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 26.58
   Well screen length............... 10
   Static height of water in well... 26.58

```
   Gravel pack porosity............. 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.411
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 118
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	3.8727E-005	+/-	5.0540E-007 ft/min
y0 =	7.8414E-001	+/-	4.0214E-003 ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 37
   Number of estimated parameters.... 2
   Degrees of freedom............... 35
   Residual mean.................... 0.0002284
   Residual standard deviation....... 0.009762
```

Residual variance................ 9.531E-005

Model Residuals:

Time	Observed	Calculated	Residual	Weight
2	0.76	0.73447	0.025534	1
2.5	0.74	0.72255	0.017452	1
3	0.72	0.71082	0.0091774	1
3.5	0.7	0.69929	0.0007123	1
4	0.69	0.68794	0.00206	1
4.5	0.68	0.67678	0.0032236	1
5	0.66	0.66579	-0.0057939	1
5.5	0.66	0.65499	0.0050103	1
6	0.64	0.64436	-0.0043608	1
6.5	0.63	0.6339	-0.0039044	1
7	0.62	0.62362	-0.0036177	1
7.5	0.61	0.6135	-0.0034979	1
8	0.6	0.60354	-0.0035423	1
8.5	0.58	0.59375	-0.013748	1
9	0.57	0.58411	-0.014113	1
9.5	0.57	0.57463	-0.0046344	1
10	0.56	0.56531	-0.0053095	1
11	0.54	0.54711	-0.0071112	1
12	0.52	0.5295	-0.0094987	1
13	0.5	0.51245	-0.012453	1
14	0.49	0.49596	-0.0059564	1
15	0.47	0.47999	-0.0099907	1
16	0.46	0.46454	-0.0045389	1
17	0.45	0.44958	0.00041546	1
18	0.43	0.43511	-0.0051116	1
19	0.41	0.4211	-0.011105	1
20	0.41	0.40755	0.0024515	1

21	0.39	0.39443	-0.0044287	1
22	0.38	0.38173	-0.0017314	1
23	0.37	0.36944	0.00055726	1
24	0.38	0.35755	0.02245	1
25	0.36	0.34604	0.01396	1
26	0.35	0.3349	0.0151	1
27	0.33	0.32412	0.0058811	1
28	0.32	0.31368	0.0063151	1
29	0.31	0.30359	0.0064132	1
30	0.3	0.29381	0.0061862	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

```
          Estimate
   K  =   3.8727E-005 ft/min
   y0 =   7.8414E-001 ft
```

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

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A Q T E S O L V   R E S U L T S

Version 2.0

Developed by Glenn M. Duffield

10/23/97 14:23:57

==

TEST DESCRIPTION

Data set........... MW21SO.DAT
Output file........ MW21SO.OUT
Data set title..... MW-21 SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/17/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 1.1
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 26.58
   Well screen length............... 10
   Static height of water in well... 26.58

```
   Gravel pack porosity............. 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.411
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 122
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
           Estimate          Std. Error
   K  =   5.3492E-005 +/-   6.2581E-007 ft/min
   y0 =   7.4301E-001 +/-   3.8194E-003 ft
```

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 32
   Number of estimated parameters.... 2
   Degrees of freedom............... 30
   Residual mean.................... 0.0001483
   Residual standard deviation....... 0.007822
```

Residual variance................ 6.119E-005

Model Residuals:

Time	Observed	Calculated	Residual	Weight
2	0.69	0.67879	0.011211	1
2.5	0.67	0.66362	0.0063782	1
3	0.65	0.64879	0.0012069	1
3.5	0.64	0.6343	0.0057041	1
4	0.62	0.62012	-0.00012253	1
4.5	0.61	0.60627	0.0037341	1
5	0.59	0.59272	-0.0027189	1
5.5	0.58	0.57947	0.00052542	1
6	0.56	0.56653	-0.0065262	1
6.5	0.54	0.55387	-0.013867	1
7	0.54	0.54149	-0.001491	1
7.5	0.53	0.52939	0.00060857	1
8	0.52	0.51756	0.0024378	1
8.5	0.51	0.506	0.0040027	1
9	0.5	0.49469	0.0053093	1
9.5	0.47	0.48364	-0.013637	1
10	0.46	0.47283	-0.01283	1
11	0.44	0.45194	-0.011935	1
12	0.43	0.43196	-0.001964	1
13	0.41	0.41288	-0.0028752	1
14	0.39	0.39463	-0.00463	1
15	0.38	0.37719	0.002809	1
16	0.36	0.36052	-0.00052266	1
17	0.35	0.34459	0.0054091	1
18	0.35	0.32936	0.020637	1
19	0.31	0.31481	-0.0048084	1
20	0.3	0.3009	-0.00089682	1

21	0.28	0.2876	-0.0076	1
22	0.27	0.27489	-0.0048907	1
23	0.27	0.26274	0.0072569	1
24	0.26	0.25113	0.0088677	1
25	0.25	0.24003	0.0099654	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	5.3492E-005 ft/min
y0 =	7.4301E-001 ft

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

SE1000B
Environmental Logger
15-Aug 20:03

P31 MW-22 ⑮ 12/19/97

Unit#	331	Test#	4
INPUT	1:00	Level (F)	TOC
Reference	94.2		
Scale factor	9.97		
Offset	0.03		
Step#	0	15-Aug	13:38
Step#	1	15-Aug	15:08

P-31 MW-22

Time	Slug In	Slug Out
0	93.68	93.64
0.0033	93.67	93.64
0.0066	93.68	93.65
0.0099	93.68	93.68
0.0133	93.68	95.4
0.0166	93.68	94.73
0.02	93.68	94.22
0.0233	93.32	94.89
0.0266	92.85	95.48
0.03	92.78	95.76
0.0333	92.51	95.92
0.05	91.62	95.7
0.0666	91.56	95.58
0.0833	91.37	95.46
0.1	91.77	95.36
0.1166	92.78	95.26
0.1333	91.96	95.17
0.15	92.08	95.07
0.1666	92.18	95
0.1833	92.27	94.91
0.2	92.36	94.84
0.2166	92.45	94.77
0.2333	92.53	94.7
0.25	92.61	94.63
0.2666	92.7	94.57
0.2833	92.76	94.51
0.3	92.83	94.45
0.3166	92.9	94.4
0.3333	92.97	94.35
0.4167	93.33	94.14
0.5	93.56	93.99
0.5833	93.65	93.87
0.6667	93.68	93.79
0.75	93.68	93.74
0.8333	93.68	93.7
0.9167	93.68	93.68
1	93.68	93.67
1.0833	93.68	93.65
1.1667	93.68	93.65
1.25	93.68	93.65

P31 MW-22

Time	Slug In	Slug Out
1.3333	93.68	93.64
1.4166	93.68	93.64
1.5	93.68	93.64
1.5833	93.68	93.64
1.6667	93.68	93.64
1.75	93.68	93.64
1.8333	93.68	93.64
1.9167	93.68	93.64
2	93.67	93.64
2.5	93.68	93.64
3	93.68	93.64
3.5	93.68	93.64
4	93.68	93.64
4.5	93.68	93.64
5	93.68	93.64
5.5	93.68	93.64
6	93.68	93.64
6.5	93.68	93.64
7	93.68	93.64
7.5	93.67	93.64
8	93.68	93.64
8.5	93.68	93.64
9	93.68	93.64
9.5	93.68	93.64
10	93.68	93.64
11	93.68	93.64
12	93.68	93.64
13	93.68	93.64
14	93.68	93.64
15	93.68	93.64
16	93.67	93.64
17	93.67	93.64
18	93.67	93.64
19	93.67	93.63
20	93.67	93.63
21	93.67	93.64
22	93.67	93.63
23	93.67	93.63
24	93.67	93.63
25	93.67	93.63

P-31 MW-22

Time	Slug In	Slug Out
26	93.67	93.63
27	93.67	93.63
28	93.67	93.63
29	93.67	93.63
30	93.67	93.63
31	93.67	93.63
32	93.66	93.63
33	93.67	93.63
34	93.67	93.63
35	93.67	93.63
36	93.66	93.63
37	93.66	93.63
38	93.66	93.63
39	93.66	93.63
40	93.66	93.63
41	93.66	93.63
42	93.66	93.63
43	93.66	93.63
44	93.66	93.63
45	93.66	93.63
46	93.66	93.62
47	93.66	93.63
48	93.66	93.62
49	93.66	93.62
50	93.66	93.62
51	93.66	93.62
52	93.66	93.62
53	93.66	93.62
54	93.66	93.62
55	93.66	93.62
56	93.66	93.62
57	93.66	93.62
58	93.65	93.62
59	93.65	93.62
60	93.66	93.62
61	93.66	93.62
62	93.66	93.62
63	93.65	93.62
64	93.65	93.62
65	93.66	93.62

mw-22
P-31

Time	Slug In	Slug Out
66	93.65	93.62
67	93.66	93.62
68	93.65	93.62
69	93.65	93.62
70	93.65	93.62
71	93.65	93.62
72	93.65	93.62
73	93.65	93.63
74	93.65	93.63
75	93.65	93.63
76	93.65	93.63
77	93.65	93.63
78	93.65	93.63
79	93.65	93.63
80	93.65	93.62
81	93.65	93.62
82	93.65	93.62
83	93.65	93.62
84	93.65	93.62
85	93.65	93.62
86	93.65	93.62
87	93.65	93.62
88	93.65	93.62
89	93.65	93.63
90		93.63
91		93.63
92		93.63
93		93.63
94		93.63
95		93.63
96		93.63
97		93.63
98		93.63
99		93.63
100		93.63
101		93.63
102		93.63
103		93.63
104		93.63
105		93.63

mw-22
~~P-31~~

14 12/19/97

Time	Slug In	Slug Out
106		93.63
107		93.63
108		93.63
109		93.63
110		93.63
111		93.63
112		93.63
113		93.63
114		93.63
115		93.63
116		93.63
117		93.63
118		93.63
119		93.63
120		93.63
121		93.63
122		93.62
123		93.62
124		93.63
125		93.63
126		93.63
127		93.63
128		93.63
129		93.63
130		93.63
131		93.63
132		93.63
133		93.62
134		93.62
135		93.62
136		93.62
137		93.62
138		93.62
139		93.62

MW-23 MW-23 MW-23 MW-23

~~P-30~~ ~~P-30~~ ~~P-30~~ ~~P-30~~ JH 12/19/97

Time	Slug In	Slug Out	Time	Slug In	Slug Out	Time	Slug In	Slug Out	Time	Slug In
66	39.47	39.85	106	39.48	39.67	146	39.45	39.54	186	
67	39.47	39.84	107	39.48	39.67	147	39.45	39.54	187	
68	39.47	39.83	108	39.48	39.67	148	39.45	39.54	188	
69	39.47	39.83	109	39.48	39.66	149	39.45	39.54	189	
70	39.47	39.82	110	39.48	39.66	150	39.45	39.54	190	
71	39.48	39.82	111	39.48	39.66	151	39.45	39.53	191	
72	39.48	39.81	112	39.48	39.66	152	39.45	39.53	192	
73	39.48	39.81	113	39.48	39.65	153	39.44	39.53	193	
74	39.48	39.8	114	39.48	39.65	154	39.44	39.53	194	
75	39.48	39.8	115	39.48	39.64	155	39.44	39.52	195	
76	39.48	39.79	116	39.48	39.64	156	39.44	39.52	196	
77	39.48	39.79	117	39.48	39.64	157	39.44	39.52	197	
78	39.48	39.78	118	39.48	39.63	158	39.44	39.52	198	
79	39.48	39.78	119	39.48	39.63	159	39.44	39.51	199	
80	39.47	39.77	120	39.48	39.63	160	39.44	39.51	200	
81	39.48	39.77	121	39.47	39.62	161	39.44	39.51	201	
82	39.48	39.77	122	39.48	39.62	162	39.44	39.5	202	
83	39.48	39.76	123	39.48	39.61	163	39.44	39.5	203	
84	39.48	39.76	124	39.47	39.61	164	39.43	39.5	204	
85	39.48	39.76	125	39.48	39.61	165	39.43	39.5	205	
86	39.48	39.75	126	39.48	39.6	166	39.43	39.49	206	
87	39.49	39.75	127	39.47	39.6	167	39.43	39.49	207	
88	39.48	39.74	128	39.47	39.6	168	39.43	39.49	208	
89	39.49	39.74	129	39.47	39.6	169	39.43	39.48	209	
90	39.48	39.73	130	39.47	39.6	170	39.43	39.48	210	
91	39.48	39.73	131	39.48	39.59	171	39.43	39.48	211	
92	39.49	39.73	132	39.47	39.59	172	39.43	39.48	212	
93	39.48	39.72	133	39.47	39.59	173	39.43	39.48	213	
94	39.48	39.72	134	39.47	39.58	174	39.43	39.47	214	
95	39.48	39.71	135	39.47	39.58	175	39.43	39.47	215	
96	39.48	39.71	136	39.47	39.58	176	39.43	39.47	216	
97	39.48	39.71	137	39.47	39.57	177	39.43	39.47	217	
98	39.49	39.7	138	39.47	39.57	178	39.43	39.46	218	
99	39.49	39.7	139	39.46	39.57	179	39.42	39.46	219	
100	39.48	39.7	140	39.46	39.56	180	39.42	39.46	220	
101	39.49	39.69	141	39.47	39.56	181		39.46	221	
102	39.49	39.69	142	39.46	39.56	182		39.45	222	
103	39.48	39.69	143	39.46	39.56	183		39.45	223	
104	39.48	39.68	144	39.46	39.55	184		39.45	224	
105	39.48	39.68	145	39.45	39.55	185		39.45	225	

2/1/96 2:19 PM
g:\proj\tf320\aqtest\P30MC.XLS

~~000507~~ SH 12/18/97

SE1000B
Environmental Logger
15-Aug 19:43

~~P-30~~ MW-23 JH 12/19/92

Unit# 331 Test# 1

INPUT 1:00 Level (F) TOC

Reference 39.89
Scale factor 9.97
Offset 0.03

Step# 0 14-Aug 10:40
Step# 1 14-Aug 13:41

Time	Slug In	Slug Out	Time	Slug In	Slug Out	Time	Slug In	Slug Out
	~~P-30~~ MW-23			~~P-30~~ MW-23			~~P-30~~ MW-23	
0	39.88	39.42	1.3333	38.42	41.06	26	39.33	40.16
0.0033	39.88	39.51	1.4166	38.41	41.05	27	39.34	40.15
0.0066	39.88	40.4	1.5	38.45	41.03	28	39.35	40.13
0.0099	39.87	40	1.5833	38.47	41.02	29	39.35	40.13
0.0133	39.88	40.06	1.6667	38.49	41.01	30	39.36	40.12
0.0166	38.19	40.09	1.75	38.51	41	31	39.37	40.1
0.02	38.17	39.45	1.8333	38.52	40.99	32	39.37	40.09
0.0233	38.03	40.49	1.9167	38.54	40.98	33	39.38	40.08
0.0266	38.25	39.99	2	38.55	40.97	34	39.38	40.07
0.03	37.52	39.72	2.5	38.62	40.91	35	39.39	40.06
0.0333	36.66	40.68	3	38.68	40.86	36	39.39	40.06
0.05	37.48	42.07	3.5	38.74	40.81	37	39.4	40.04
0.0666	36.87	41.81	4	38.78	40.77	38	39.4	40.03
0.0833	37.47	41.72	4.5	38.82	40.74	39	39.4	40.03
0.1	37.85	41.67	5	38.86	40.7	40	39.41	40.01
0.1166	38.29	41.62	5.5	38.89	40.68	41	39.41	40.01
0.1333	37.76	41.58	6	38.92	40.65	42	39.42	40
0.15	37.77	41.55	6.5	38.95	40.62	43	39.42	40
0.1666	37.8	41.53	7	38.97	40.6	44	39.42	39.99
0.1833	37.79	41.5	7.5	39	40.58	45	39.43	39.98
0.2	37.99	41.48	8	39.02	40.56	46	39.43	39.97
0.2166	37.96	41.46	8.5	39.04	40.54	47	39.47	39.97
0.2333	37.93	41.44	9	39.06	40.52	48	39.43	39.96
0.25	37.99	41.43	9.5	39.08	40.5	49	39.44	39.95
0.2666	38	41.42	10	39.09	40.48	50	39.44	39.94
0.2833	38.02	41.4	11	39.13	40.45	51	39.44	39.94
0.3	38.03	41.59	12	39.15	40.42	52	39.45	39.93
0.3166	38.04	41.43	13	39.17	40.39	53	39.45	39.92
0.3333	38.05	41.37	14	39.19	40.37	54	39.45	39.9
0.4167	38.13	41.31	15	39.21	40.34	55	39.45	39.9
0.5	38.14	41.27	16	39.22	40.32	56	39.46	39.9
0.5833	38.19	41.24	17	39.23	40.3	57	39.46	39.89
0.6667	38.23	41.21	18	39.24	40.28	58	39.46	39.89
0.75	38.25	41.19	19	39.26	40.27	59	39.46	39.89
0.8333	38.29	41.17	20	39.27	40.25	60	39.46	39.87
0.9167	38.31	41.15	21	39.28	40.23	61	39.46	39.87
1	38.34	41.13	22	39.29	40.22	62	39.46	39.87
1.0833	38.38	41.11	23	39.31	40.2	63	39.47	39.87
1.1667	38.38	41.09	24	39.31	40.19	64	39.47	39.86
1.25	38.39	41.08	25	39.32	40.17	65	39.47	39.85

JH 12/19/97

		mw-23 ~~P-30~~			mw-23 ~~P-30~~			mw-23 ~~P-30~~	
Slug Out	Time	Slug In	Slug Out	Time	Slug In	Slug Out	Time	Slug In	Slug Out
39.44	226		39.35	266		39.27	306		39.19
39.44	227		39.35	267		39.26	307		39.19
39.44	228		39.35	268		39.26	308		39.19
39.43	229		39.34	269		39.26	309		39.19
39.43	230		39.34	270		39.26	310		39.18
39.43	231		39.34	271		39.26	311		39.18
39.43	232		39.34	272		39.25	312		39.18
39.43	233		39.34	273		39.25	313		39.18
39.43	234		39.33	274		39.25	314		39.18
39.42	235		39.33	275		39.25	315		39.18
39.42	236		39.33	276		39.25	316		39.17
39.42	237		39.33	277		39.25	317		39.17
39.42	238		39.32	278		39.24	318		39.17
39.41	239		39.32	279		39.24	319		39.17
39.41	240		39.32	280		39.24	320		39.17
39.41	241		39.32	281		39.24	321		39.17
39.41	242		39.31	282		39.24	322		39.16
39.4	243		39.31	283		39.23	323		39.16
39.4	244		39.31	284		39.23	324		39.16
39.4	245		39.31	285		39.23	325		39.16
39.4	246		39.31	286		39.23	326		39.16
39.39	247		39.31	287		39.23	327		39.15
39.39	248		39.3	288		39.22	328		39.15
39.39	249		39.3	289		39.22	329		39.15
39.39	250		39.3	290		39.22	330		39.15
39.38	251		39.3	291		39.22	331		39.15
39.38	252		39.29	292		39.22			
39.38	253		39.29	293		39.21			
39.38	254		39.29	294		39.21			
39.37	255		39.29	295		39.21			
39.37	256		39.29	296		39.21			
39.37	257		39.29	297		39.21			
39.37	258		39.28	298		39.21			
39.37	259		39.28	299		39.2			
39.36	260		39.28	300		39.2			
39.36	261		39.28	301		39.2			
39.36	262		39.27	302		39.2			
39.36	263		39.27	303		39.2			
39.35	264		39.27	304		39.2			
39.35	265		39.27	305		39.2			

SE1000B
Environmental Logger
23-Aug 15:12

~~P-29~~ MW-24 JH 12/9/97

Unit# 331 Test# 2

INPUT 1:00 Level (F) TOC

Reference 16.5
Scale factor 9.97
Offset 0.03

Step# 0 16-Aug 18:01
Step# 1 16-Aug 20:00

MW-24 ~~P-29~~

Time	Slug In	Slug Out
0	16.52	16.8
0.0033	16.52	16.83
0.0066	16.52	17.62
0.0099	16.52	17.38
0.0133	16.52	17.59
0.0166	16.52	17.87
0.02	16.52	18.12
0.0233	16.57	18.39
0.0266	16.49	18.48
0.03	16.54	18.46
0.0333	16.63	18.43
0.05	16.02	18.39
0.0666	15.33	18.41
0.0833	14.49	18.38
0.1	14.31	18.36
0.1166	14.4	18.39
0.1333	14.31	18.34
0.15	14.15	18.25
0.1666	13.95	18.34
0.1833	14.15	18.34
0.2	13.99	18.34
0.2166	14.3	18.34
0.2333	14.1	18.34
0.25	14.58	18.34
0.2666	14.42	18.34
0.2833	14.09	18.33
0.3	14.15	18.33
0.3166	14.18	18.33
0.3333	14.2	18.33
0.4167	14.18	18.33
0.5	14.22	18.32
0.5833	14.23	18.32
0.6667	14.26	18.31
0.75	14.26	18.31
0.8333	14.28	18.3
0.9167	14.29	18.29
1	14.31	18.29
1.0833	14.31	18.28
1.1667	14.33	18.28
1.25	14.34	18.28

MW-24 ~~P-29~~

Time	Slug In	Slug Out
1.3333	14.35	18.27
1.4166	14.37	18.27
1.5	14.38	18.26
1.5833	14.39	18.26
1.6667	14.39	18.25
1.75	14.42	18.25
1.8333	14.42	18.24
1.9167	14.43	18.24
2	14.44	18.23
2.5	14.49	18.21
3	14.55	18.18
3.5	14.6	18.16
4	14.67	18.14
4.5	14.74	18.11
5	14.8	18.09
5.5	14.86	18.07
6	14.92	18.05
6.5	14.98	18.03
7	15.03	18
7.5	15.08	17.99
8	15.12	17.96
8.5	15.17	17.94
9	15.21	17.93
9.5	15.25	17.9
10	15.29	17.88
11	15.38	17.85
12	15.45	17.81
13	15.51	17.77
14	15.58	17.74
15	15.63	17.71
16	15.69	17.68
17	15.75	17.65
18	15.8	17.62
19	15.84	17.59
20	15.89	17.57
21	15.93	17.54
22	15.97	17.51
23	16.01	17.49
24	16.04	17.46
25	16.08	17.44

MW-24 ~~P-29~~

Time	Slug In	Slug Out
26	16.11	17.42
27	16.15	17.4
28	16.18	17.38
29	16.21	17.36
30	16.23	17.34
31	16.26	17.32
32	16.29	17.3
33	16.31	17.29
34	16.33	17.27
35	16.35	17.25
36	16.38	17.24
37	16.4	17.22
38	16.42	17.21
39	16.44	17.19
40	16.45	17.18
41	16.47	17.17
42	16.49	17.15
43	16.5	17.14
44	16.52	17.13
45	16.53	17.12
46	16.54	17.11
47	16.55	17.1
48	16.57	17.09
49	16.58	17.08
50	16.59	17.07
51	16.6	17.06
52	16.61	17.05
53	16.62	17.04
54	16.63	17.04
55	16.64	17.03
56	16.65	17.02
57	16.66	17.01
58	16.67	17.01
59	16.67	17
60	16.68	17
61	16.69	16.99
62	16.69	16.99
63	16.7	16.98
64	16.71	16.97
65	16.71	16.97

~~P-29~~ MW-24

Time	Slug In	Slug Out
66	16.72	16.96
67	16.72	16.96
68	16.73	16.95
69	16.73	16.95
70	16.73	16.95
71	16.74	16.94
72	16.74	16.94
73	16.75	16.93
74	16.75	16.93
75	16.75	16.93
76	16.76	16.92
77	16.76	16.92
78	16.76	16.92
79	16.77	16.91
80	16.77	16.91
81	16.77	16.91
82	16.78	16.9
83	16.78	16.9
84	16.78	16.9
85	16.78	16.9
86	16.78	16.9
87	16.78	16.89
88	16.78	16.89
89	16.79	16.89
90	16.79	16.89
91	16.79	16.88
92	16.79	16.88
93	16.79	16.88
94	16.79	16.88
95	16.79	16.88
96	16.8	16.88
97	16.8	16.87
98	16.8	16.87
99	16.8	16.87
100	16.8	16.87
101	16.8	16.87
102	16.8	16.87
103	16.8	16.86
104	16.8	16.86
105	16.8	16.86

~~P-29~~ MW-24

Time	Slug In	Slug Out
106	16.8	16.86
107	16.8	16.86
108	16.81	16.86
109	16.81	16.86
110	16.81	16.86
111	16.81	16.86
112	16.81	16.85
113	16.81	16.85
114	16.81	16.85
115	16.81	16.85
116	16.81	16.85
117	16.81	16.85
118	16.81	16.85
119		16.85
120		16.85
121		16.85
122		16.85
123		16.85
124		16.84
125		16.84
126		16.84
127		16.84
128		16.84
129		16.84
130		16.84
131		16.84
132		16.84
133		16.84
134		16.84
135		16.84
136		16.84
137		16.84
138		16.84
139		16.84
140		16.84
141		16.84
142		16.84
143		16.84
144		16.84
145		16.84

~~P-29~~ MW-24

Time	Slug In	Slug Out
146		16.84
147		16.84
148		16.84
149		16.84
150		16.84
151		16.84
152		16.84
153		16.84
154		16.84
155		16.84
156		16.84
157		16.84
158		16.84
159		16.83
160		16.84
161		16.84
162		16.83
163		16.83
164		16.83
165		16.83
166		16.83
167		16.83
168		16.83
169		16.83
170		16.83
171		16.83
172		16.83
173		16.83
174		16.83
175		16.83
176		16.83
177		16.83
178		16.83
179		16.83
180		16.83
181		16.83
182		16.83
183		16.83
184		16.83
185		16.83

MW-24 ~~P-29~~ JH 12/19/97

Time	Slug In	Slug Out
186		16.83
187		16.83
188		16.83
189		16.83
190		16.83
191		16.83
192		16.83
193		16.83
194		16.83
195		16.83
196		16.83
197		16.83
198		16.83
199		16.83
200		16.83
201		16.83
202		16.83
203		16.83
204		16.83
205		16.83
206		16.83
207		16.82
208		16.82
209		16.82
210		16.83
211		16.82
212		16.83
213		16.82
214		16.82
215		16.82
216		16.82
217		16.82
218		16.82
219		16.82
220		16.82
221		16.82
222		16.82
223		16.82
224		16.82
225		16.82

SH 12/19/97

MW-24
~~P-29~~

Time	Slug In	Slug Out
226		16.82
227		16.82
228		16.82
229		16.82
230		16.82
231		16.82
232		16.82
233		16.82
234		16.82
235		16.82
236		16.82
237		16.82
238		16.82
239		16.82
240		16.82
241		16.82
242		16.82
243		16.82
244		16.82
245		16.82
246		16.82
247		16.82
248		16.82
249		16.82
250		16.82
251		16.82
252		16.82
253		16.82
254		16.82
255		16.82
256		16.82
257		16.82
258		16.82
259		16.82
260		16.82
261		16.82
262		16.82
263		16.81
264		16.81
265		16.81

MW-24
~~P-29~~

Time	Slug In	Slug Out
266		16.81
267		16.81
268		16.81
269		16.81
270		16.81
271		16.81
272		16.81
273		16.81
274		16.81
275		16.81
276		16.81
277		16.81
278		16.81
279		16.81
280		16.81
281		16.81
282		16.81
283		16.81
284		16.81
285		16.81
286		16.81
287		16.81
288		16.81
289		16.81
290		16.81
291		16.8
292		16.81
293		16.8
294		16.8
295		16.81
296		16.8
297		16.81
298		16.8
299		16.8
300		16.8
301		16.8
302		16.8
303		16.8
304		16.8
305		16.8

MW-24
~~P-29~~

Time	Slug In	Slug Out
306		16.8
307		16.8
308		16.8
309		16.8
310		16.8
311		16.8
312		16.8
313		16.8
314		16.8
315		16.8
316		16.8
317		16.8
318		16.8
319		16.8
320		16.8
321		16.8
322		16.8
323		16.8
324		16.8
325		16.8
326		16.8
327		16.8
328		16.79
329		16.8
330		16.8
331		16.79
332		16.79
333		16.79
334		16.79
335		16.79
336		16.79
337		16.79
338		16.79
339		16.79
340		16.79
341		16.79
342		16.79
343		16.79
344		16.79
345		16.79

MW-24
~~P-29~~

Time	Slug In	Slug Out
346		16.79
347		16.79
348		16.79
349		16.79
350		16.79
351		16.79
352		16.79
353		16.79
354		16.79
355		16.79
356		16.79
357		16.79
358		16.79
359		16.79
360		16.79
361		16.79
362		16.78
363		16.79
364		16.79
365		16.79
366		16.79
367		16.79
368		16.79
369		16.79
370		16.79
371		16.78
372		16.78
373		16.78
374		16.78
375		16.78
376		16.78
377		16.78
378		16.78
379		16.78
380		16.78
381		16.78
382		16.78
383		16.78
384		16.78
385		16.78

MW-24 JH 12/19/97

MW-24
~~P-29~~

Time	Slug In	Slug Out
386		16.78
387		16.78
388		16.78
389		16.78
390		16.78
391		16.78
392		16.78
393		16.78
394		16.78
395		16.78
396		16.78
397		16.78
398		16.78
399		16.78
400		16.78
401		16.78
402		16.78
403		16.78
404		16.78
405		16.78
406		16.78
407		16.78
408		16.78
409		16.78
410		16.78
411		16.78
412		16.78
413		16.78
414		16.78
415		16.78
416		16.78
417		16.78
418		16.78
419		16.78
420		16.78
421		16.78
422		16.78
423		16.78
424		16.78
425		16.77

MW-24
~~P-29~~

Time	Slug In	Slug Out
426		16.77
427		16.77
428		16.78
429		16.77
430		16.77
431		16.78
432		16.77
433		16.77
434		16.77
435		16.77
436		16.77
437		16.78
438		16.77
439		16.77
440		16.77
441		16.78
442		16.78
443		16.77
444		16.77
445		16.77
446		16.77
447		16.77
448		16.77
449		16.77
450		16.77
451		16.77
452		16.77
453		16.77
454		16.77
455		16.77
456		16.77
457		16.77
458		16.77
459		16.77
460		16.77
461		16.77
462		16.77
463		16.77
464		16.77
465		16.77

MW-24
~~P-29~~

Time	Slug In	Slug Out
466		16.77
467		16.77
468		16.77
469		16.77
470		16.77
471		16.77
472		16.77
473		16.77
474		16.77
475		16.77
476		16.77
477		16.77
478		16.77
479		16.77
480		16.77
481		16.76
482		16.77
483		16.77
484		16.76
485		16.76
486		16.76
487		16.76
488		16.76
489		16.76
490		16.77
491		16.77
492		16.76
493		16.77
494		16.76
495		16.77
496		16.77
497		16.76
498		16.77
499		16.76
500		16.77
501		16.77
502		16.77
503		16.76
504		16.77
505		16.77

MW-24
~~P-29~~

Time	Slug In	Slug Out
506		16.77
507		16.77
508		16.77
509		16.77
510		16.77
511		16.76
512		16.76
513		16.76
514		16.76
515		16.77
516		16.77
517		16.76
518		16.76
519		16.76
520		16.76
521		16.77
522		16.76
523		16.76
524		16.76
525		16.76
526		16.76
527		16.76
528		16.76
529		16.76
530		16.76
531		16.76
532		16.76
533		16.76
534		16.76
535		16.76
536		16.76
537		16.76
538		16.76
539		16.76
540		16.76
541		16.76
542		16.76
543		16.76
544		16.76
545		16.76

MW-24
~~P-29~~

Time	Slug In	Slug Out
546		16.76
547		16.76
548		16.76
549		16.76
550		16.76
551		16.76
552		16.76
553		16.76
554		16.76
555		16.76
556		16.76
557		16.76
558		16.76
559		16.76
560		16.76
561		16.76
562		16.76
563		16.76
564		16.76
565		16.76
566		16.76
567		16.75
568		16.76
569		16.76
570		16.76
571		16.76
572		16.76
573		16.76
574		16.76
575		16.76
576		16.75
577		16.75
578		16.76
579		16.76
580		16.75
581		16.76
582		16.75
583		16.76
584		16.76
585		16.76

MW-24
~~P-29~~

Time	Slug In	Slug Out
586		16.75
587		16.75
588		16.76
589		16.76
590		16.75
591		16.75
592		16.76
593		16.75
594		16.75
595		16.75
596		16.76
597		16.75
598		16.76
599		16.76
600		16.76
601		16.75
602		16.75
603		16.75
604		16.75
605		16.75
606		16.76
607		16.75
608		16.76
609		16.75
610		16.76
611		16.76
612		16.76
613		16.75
614		16.76
615		16.76
616		16.76
617		16.75
618		16.76
619		16.76
620		16.75
621		16.75
622		16.76
623		16.76
624		16.75
625		16.76

MW-24
~~P-29~~

Time	Slug In	Slug Out
626		16.76
627		16.76
628		16.76
629		16.76
630		16.76
631		16.75
632		16.75
633		16.76
634		16.76
635		16.76
636		16.76
637		16.76
638		16.76
639		16.76
640		16.76
641		16.76
642		16.75
643		16.76
644		16.76
645		16.75
646		16.76
647		16.76
648		16.76
649		16.76
650		16.76
651		16.76
652		16.76
653		16.76
654		16.76
655		16.76
656		16.75
657		16.76
658		16.76
659		16.76
660		16.76
661		16.76
662		16.76
663		16.75
664		16.76
665		16.75

MW-24
~~P-29~~

JH 12/19/97

Time	Slug In	Slug Out
666		16.76
667		16.76
668		16.76
669		16.76
670		16.76
671		16.76
672		16.76
673		16.75
674		16.76
675		16.76
676		16.76
677		16.76
678		16.76
679		16.76
680		16.75
681		16.76
682		16.76
683		16.76
684		16.76
685		16.76
686		16.75
687		16.76
688		16.76
689		16.76
690		16.76
691		16.76
692		16.76
693		16.76
694		16.76
695		16.76
696		16.76
697		16.76
698		16.76

SE1000B
Environmental Logger
15-Aug 19:57

~~P-28S~~ MW-25S (JH) 12/19/97

Unit#	331	Test#		3
INPUT	1:00	Level	(F)	TOC
Reference	94.2			
Scale factor	9.97			
Offset	0.03			
Step#	0	15-Aug	7:55	
Step#	1	15-Aug	10:02	

MW-25S ~~P-28S~~

Time	Slug In	Slug Out
0	95.28	95.25
0.0033	95.28	95.28
0.0066	95.28	95.59
0.0099	95.28	96.07
0.0133	95.26	96.11
0.0166	95.27	95.97
0.02	95.27	96.15
0.0233	95.28	96.65
0.0266	95.28	97.03
0.03	95.28	97.05
0.0333	95.27	96.78
0.05	94.26	96.75
0.0666	93.99	96.7
0.0833	93.65	96.67
0.1	93.37	96.65
0.1166	93.39	96.64
0.1333	93.47	96.61
0.15	93.52	96.59
0.1666	93.55	96.57
0.1833	93.62	96.56
0.2	93.52	96.54
0.2166	93.48	96.52
0.2333	93.54	96.52
0.25	93.57	96.51
0.2666	93.61	96.5
0.2833	93.64	96.48
0.3	93.67	96.47
0.3166	93.7	96.46
0.3333	93.73	96.45
0.4167	93.85	96.41
0.5	93.95	96.37
0.5833	94.04	96.34
0.6667	94.1	96.31
0.75	94.13	96.29
0.8333	94.19	96.26
0.9167	94.23	96.24
1	94.27	96.22
1.0833	94.31	96.21
1.1667	94.34	96.19
1.25	94.37	96.18
1.3333	94.4	96.16
1.4166	94.43	96.15

MW-25S ~~P-28S~~

Time	Slug In	Slug Out
1.5	94.45	96.14
1.5833	94.48	96.12
1.6667	94.49	96.11
1.75	94.52	96.1
1.8333	94.54	96.09
1.9167	94.56	96.08
2	94.58	96.07
2.5	94.68	96.01
3	94.75	95.96
3.5	94.81	95.91
4	94.86	95.87
4.5	94.9	95.84
5	94.95	95.8
5.5	94.98	95.78
6	95	95.75
6.5	95.03	95.72
7	95.05	95.7
7.5	95.06	95.69
8	95.07	95.67
8.5	95.09	95.65
9	95.1	95.63
9.5	95.12	95.62
10	95.13	95.6
11	95.15	95.57
12	95.16	95.56
13	95.18	95.54
14	95.18	95.52
15	95.19	95.51
16	95.2	95.49
17	95.21	95.47
18	95.21	95.47
19	95.22	95.46
20	95.22	95.44
21	95.23	95.44
22	95.23	95.43
23	95.23	95.43
24	95.24	95.42
25	95.24	95.41
26	95.24	95.41
27	95.24	95.4
28	95.24	95.4
29	95.25	95.4

MW-25S ~~P-28S~~

Time	Slug In	Slug Out
30	95.25	95.4
31	95.25	95.39
32	95.25	95.39
33	95.25	95.38
34	95.26	95.38
35	95.26	95.38
36	95.26	95.38
37	95.26	95.38
38	95.26	95.37
39	95.26	95.37
40	95.26	95.37
41	95.26	95.37
42	95.26	95.37
43	95.26	95.36
44	95.26	95.36
45	95.26	95.36
46	95.26	95.36
47	95.26	95.35
48	95.26	95.35
49	95.26	95.35
50	95.26	95.35
51	95.26	95.35
52	95.26	95.35
53	95.26	95.35
54	95.27	95.35
55	95.26	95.34
56	95.27	95.35
57	95.27	95.35
58	95.27	95.34
59	95.27	95.34
60	95.26	95.34
61	95.26	95.34
62	95.26	95.34
63	95.26	95.34
64	95.27	95.34
65	95.26	95.34
66	95.26	95.34
67	95.26	95.34
68	95.26	95.34
69	95.26	95.34
70	95.25	95.34
71	95.25	95.34

MW-25S
~~P-28S~~

Time	Slug In	Slug Out
72	95.24	95.34
73	95.25	95.34
74	95.25	95.35
75	95.25	95.35
76	95.26	95.34
77	95.25	95.34
78	95.26	95.34
79	95.26	95.35
80	95.26	95.34
81	95.26	95.34
82	95.26	95.34
83	95.26	95.34
84	95.26	95.34
85	95.26	95.34
86	95.27	95.34
87	95.27	95.34
88	95.27	95.34
89	95.27	95.35
90	95.27	95.34
91	95.27	95.34
92	95.27	95.34
93	95.27	95.34
94	95.27	95.34
95	95.27	95.34
96	95.27	95.34
97	95.27	95.34
98	95.27	95.33
99	95.27	95.34
100	95.27	95.34
101	95.27	95.34
102	95.27	95.34
103	95.27	95.34
104	95.27	95.33
105	95.27	95.34
106	95.27	95.34
107	95.27	95.34
108	95.27	95.34
109	95.27	95.34
110	95.27	95.34
111	95.27	95.34
112	95.27	95.34
113	95.27	95.34

MW-25S
~~P-28S~~

Time	Slug In	Slug Out
114	95.27	95.34
115	95.27	95.34
116	95.27	95.34
117	95.27	95.34
118	95.27	95.34
119	95.27	95.34
120	95.28	95.34
121	95.27	95.34
122	95.27	95.34
123	95.27	95.34
124	95.27	95.34
125	95.27	95.34
126	95.28	95.34
127	95.25	95.34
128		95.34
129		95.34
130		95.34
131		95.34
132		95.34
133		95.34
134		95.34
135		95.33
136		95.34
137		95.34
138		95.34
139		95.34
140		95.34
141		95.34
142		95.34
143		95.34
144		95.33
145		95.34
146		95.33
147		95.34
148		95.34
149		95.34
150		95.34
151		95.34
152		95.34
153		95.34
154		95.34
155		95.34

MW-25S
~~P-28S~~

Time	Slug In	Slug Out
156		95.34
157		95.34
158		95.34
159		95.33
160		95.33
161		95.34
162		95.34
163		95.33
164		95.34
165		95.34
166		95.34
167		95.3[illegible]
168		95.34
169		95.34
170		95.34
171		95.34
172		95.34
173		95.34
174		95.34
175		95.34
176		95.34
177		95.34
178		95.33
179		95.34
180		95.34
181		95.34
182		95.34
183		95.34
184		95.33
185		95.34
186		95.34
187		95.34
188		95.34
189		95.34
190		95.34
191		95.34
192		95.34
193		95.34
194		95.34
195		95.[illegible]
196		95.[illegible]

SE1000B
Environmental Logger
17-Oct 11:23

~~28D~~ MW-25D (SD) 12/9/97

Unit# 331 Test# 2

INPUT 1:00 Level (F) TOC

Reference 16.67
Scale factor 9.97
Offset 0.03

Step# 0 13-Oct 7:50
Step# 1 13-Oct 12:51

MW-25D
~~P-28D~~

Time	Slug In	Slug Out
0	16.8	16.67
0.0033	16.8	16.69
0.0066	16.79	18.17
0.0099	16.81	17.94
0.0133	16.8	17.7
0.0166	16.75	17.36
0.02	16.38	16.78
0.0233	15.14	17.57
0.0266	15.67	17.77
0.03	15.56	17.62
0.0333	14.5	16.95
0.05	13.95	18.49
0.0666	13.62	19.24
0.0833	14.6	19.17
0.1	14.27	19.15
0.1166	14.43	19.12
0.1333	14.41	19.11
0.15	14.43	19.1
0.1666	14.17	19.09
0.1833	14.23	19.09
0.2	14.43	19.08
0.2166	14.48	19.08
0.2333	14.46	19.08
0.25	14.46	19.08
0.2666	14.46	19.08
0.2833	14.46	19.08
0.3	14.47	19.07
0.3166	14.47	19.07
0.3333	14.48	19.07
0.4167	14.49	19.06
0.5	14.48	19.06
0.5833	14.5	19.05
0.6667	14.52	19.05
0.75	14.53	19.04
0.8333	14.53	19.05
0.9167	14.54	19.04
1	14.54	19.03
1.0833	14.55	19.03
1.1667	14.55	19.03
1.25	14.56	19.03
1.3333	14.56	19.02

MW-25D
~~P-28D~~

Time	Slug In	Slug Out
1.4166	14.57	19.02
1.5	14.57	19.02
1.5833	14.58	19.02
1.6667	14.58	19.02
1.75	14.59	19.01
1.8333	14.59	19.01
1.9167	14.6	19.01
2	14.6	19.01
2.5	14.63	18.99
3	14.66	18.98
3.5	14.68	18.97
4	14.71	18.96
4.5	14.73	18.95
5	14.75	18.94
5.5	14.77	18.93
6	14.78	18.92
6.5	14.8	18.91
7	14.82	18.9
7.5	14.83	18.89
8	14.86	18.88
8.5	14.87	18.87
9	14.88	18.86
9.5	14.9	18.85
10	14.91	18.85
12	14.95	18.81
14	15.01	18.78
16	15.05	18.75
18	15.09	18.72
20	15.12	18.69
22	15.16	18.67
24	15.2	18.64
26	15.23	18.62
28	15.26	18.59
30	15.29	18.57
32	15.31	18.55
34	15.34	18.53
36	15.36	18.5
38	15.39	18.48
40	15.41	18.46
42	15.43	18.45
44	15.46	18.43

MW-25D
~~P-28D~~

Time	Slug In	Slug Out
230	16.5	17.53
240	16.53	17.5
250	16.56	17.48
260	16.59	17.46
270	16.61	17.44
280	16.63	17.42
290	16.65	17.4
300	16.67	17.39
310		17.37
320		17.35

2/1/96 1:03 PM
g:\proj\tf320\aqtest\P28DMC.XLS

(JH) 12/15/97
~~000500~~

SE1000B
Environmental Logger
12-Aug 8:49
MW-27

Unit# 331 Test# 4

INPUT 1:00 Level (F) TOC

Reference 17.74
Scale factor 9.97
Offset 0.03

Step# 0 10-Aug 17:13
Step# 1 10-Aug 17:34

MW-27
~~P-26~~

Time	Slug In	Slug Out
0	17.74	17.74
0.0033	17.74	17.74
0.0066	17.74	17.74
0.0099	17.74	17.74
0.0133	17.73	17.68
0.0166	17.28	17.99
0.02	17.53	18.54
0.0233	17.02	17.21
0.0266	16.67	17.95
0.03	16.2	19.38
0.0333	15.74	18.38
0.05	15.56	19.99
0.0666	16.14	19.62
0.0833	16.38	19.33
0.1	16.59	19.07
0.1166	16.77	18.88
0.1333	16.93	18.65
0.15	17.07	18.53
0.1666	17.18	18.4
0.1833	17.28	18.29
0.2	17.36	18.19
0.2166	17.45	18.11
0.2333	17.53	18.05
0.25	17.53	17.96
0.2666	17.57	17.93
0.2833	17.61	17.9
0.3	17.63	17.87
0.3166	17.65	17.85
0.3333	17.67	17.82
0.4167	17.72	17.77
0.5	17.73	17.75
0.5833	17.74	17.74
0.6667	17.74	17.74
0.75	17.74	17.74
0.8333	17.74	17.74
0.9167	17.74	17.74
1	17.74	17.74
1.0833	17.74	17.74
1.1667	17.74	17.74
1.25	17.74	17.74
1.3333	17.74	17.74
1.4166	17.74	17.74
1.5	17.74	17.74
1.5833	17.74	17.74

MW-27
~~P-26~~
JH 12/9/97

Time	Slug In	Slug Out
1.6667	17.74	17.74
1.75	17.74	17.74
1.8333	17.74	17.74
1.9167	17.74	17.74
2	17.74	17.74
2.5	17.74	17.74
3	17.74	17.74
3.5	17.74	17.74
4	17.74	17.74
4.5	17.74	17.74
5	17.74	17.74
5.5	17.74	17.74
6	17.74	17.74
6.5	17.74	17.74
7	17.74	17.74
7.5	17.74	17.74
8	17.74	17.74
8.5	17.74	17.74
9	17.74	17.74
9.5	17.74	17.74
10	17.74	17.74
11	17.74	17.74
12	17.74	
13	17.74	
14	17.74	
15	17.74	
16	17.74	
17	17.74	
18	17.74	
19	17.74	
20	17.74	

SE1000B
Environmental Logger
2-Aug 17:16

P-25 MW - 28 JH 12/19/97

Unit# 331 Test# 1

INPUT 1:00 Level (F) TOC

Reference 20.1
Scale factor 9.97
Offset 0.03

Step# 0 1-Aug 8:46
Step# 1 1-Aug 9:07

P-25 MW - 28

Time	Slug In	Slug Out
0	20.1	20.1
0.0033	20.1	20.1
0.0066	20.1	20.1
0.0099	20.08	20.1
0.0133	20.08	20.14
0.0166	20.08	22.46
0.02	20.13	21.89
0.0233	19.64	21.02
0.0266	18.63	20.95
0.03	19.25	20.98
0.0333	18.74	21.03
0.05	17.78	22.6
0.0666	17	22.45
0.0833	17.91	22.34
0.1	17.72	22.25
0.1166	18.99	22.16
0.1333	18.26	22.08
0.15	18.22	22
0.1666	18.35	21.92
0.1833	18.38	21.87
0.2	18.42	21.81
0.2166	18.51	21.75
0.2333	18.54	21.7
0.25	18.59	21.66
0.2666	18.61	21.61
0.2833	18.66	21.56
0.3	18.7	21.52
0.3166	18.74	21.48
0.3333	18.8	21.44
0.4167	18.96	21.26
0.5	19.1	21.12
0.5833	19.22	21
0.6667	19.29	20.9
0.75	19.39	20.82
0.8333	19.46	20.75
0.9167	19.52	20.68
1	19.58	20.63
1.0833	19.6	20.58
1.1667	19.65	20.54
1.25	19.7	20.51
1.3333	19.73	20.47
1.4166	19.78	20.44

P-25 MW - 28

Time	Slug In	Slug Out
1.5	19.81	20.42
1.5833	19.81	20.4
1.6667	19.83	20.38
1.75	19.86	20.36
1.8333	19.87	20.34
1.9167	19.89	20.33
2	19.91	20.31
2.5	19.95	20.25
3	20.01	20.21
3.5	20.04	20.19
4	20.05	20.17
4.5	20.06	20.15
5	20.07	20.15
5.5	20.08	20.14
6	20.08	20.13
6.5	20.08	20.13
7	20.09	20.12
7.5	20.09	20.12
8	20.09	20.12
8.5	20.09	20.12
9	20.09	20.11
9.5	20.09	20.11
10	20.09	20.11
11	20.1	20.11
12	20.1	20.11
13	20.1	20.11
14	20.1	20.1
15	20.11	20.11
16	20.11	20.11
17	20.11	20.1
18	20.11	20.11
19	20.11	20.11
20	20.11	20.1
21	20.1	20.1
22		20.1
23		20.1
24		20.1
25		20.1
26		20.1
27		20.1
28		20.1
29		20.1

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/23/97   11:19:30

==

TEST DESCRIPTION

Data set........... MW29SI.DAT
Output file........ MW29SI.OUT
Data set title..... MW-29 SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/16/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 2.31
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 10.43
   Well screen length............... 10
   Static height of water in well... 10.43

```
   Gravel pack porosity............ 0.3
   Effective well casing radius..... 0.1536
   Effective wellbore radius........ 0.25
   Log(Re/Rw)...................... 2.839
   Constants A, B and C............ 0.000 ,  0.000,  2.297
   No. of observations............. 15

================================================================================
                             ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

================================================================================
                    RESULTS FROM STATISTICAL CURVE MATCHING


STATISTICAL MATCH PARAMETER ESTIMATES

           Estimate          Std.  Error
   K  =   1.3912E-001 +/-   3.2530E-002 ft/min
   y0 =   2.9554E+000 +/-   9.2059E-001 ft


ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals.............. 8
   Number of estimated parameters.... 2
   Degrees of freedom............... 6
   Residual mean.................... 0.006072
   Residual standard deviation....... 0.118
```

Residual variance................ 0.01391

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0266	0.92	0.97949	-0.059489	1
0.03	1.06	0.85054	0.20946	1
0.0333	0.57	0.74164	-0.17164	1
0.05	0.4	0.37075	0.029251	1
0.0666	0.14	0.18611	-0.04611	1
0.0833	0.12	0.093037	0.026963	1
0.1	0.1	0.046509	0.053491	1
0.1166	0.03	0.023347	0.006653	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
K = 1.3912E-001 ft/min
y0 = 2.9554E+000 ft

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<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 2.0

Developed by Glenn M. Duffield

10/23/97 11:37:11

==

TEST DESCRIPTION

Data set........... MW29SO.DAT
Output file........ MW29SO.OUT
Data set title..... MW-29 SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/16/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 1.48
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 10.43
   Well screen length............... 10
   Static height of water in well... 10.43

```
   Gravel pack porosity............. 0.3
   Effective well casing radius..... 0.1536
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 2.839
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 34
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
K =	1.0201E-001	+/-	2.6660E-002	ft/min
y0 =	1.7810E+000	+/-	3.0832E-001	ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 12
   Number of estimated parameters.... 2
   Degrees of freedom............... 10
   Residual mean.................... -0.01483
   Residual standard deviation....... 0.2219
```

Residual variance................ 0.04924

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0099	1.48	1.3176	0.16238	1
0.0133	0.71	1.1881	-0.47807	1
0.0166	0.92	1.0745	-0.15452	1
0.02	1.16	0.96887	0.19113	1
0.0233	1.13	0.87627	0.25373	1
0.0266	0.99	0.79252	0.19748	1
0.03	0.81	0.7146	0.095398	1
0.0333	0.66	0.6463	0.013695	1
0.05	0.21	0.38874	-0.17874	1
0.0666	0.08	0.23453	-0.15453	1
0.0833	0.06	0.14107	-0.081067	1
0.1	0.04	0.084849	-0.044849	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
K = 1.3100E-001 ft/min
y0 = 1.4855E+000 ft

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SE1000B
Environmental Logger
10-Aug 8:12

~~P-24S~~ MW-30S (JH) 12/9/97

Unit# 331 Test# 4

INPUT 1:00 Level (F) TOC

Reference 26.88
Scale factor 9.97
Offset 0.03

Step# 0 9-Aug 11:02
Step# 1 9-Aug 11:28

MW-30S
~~P-24S~~

Time	Slug In	Slug Out
0	26.9	26.88
0.0033	26.9	26.88
0.0066	26.89	26.98
0.0099	26.89	28.74
0.0133	27.18	28.21
0.0166	26.85	26.74
0.02	26.9	27.66
0.0233	26.84	27.17
0.0266	26.91	26.33
0.03	26.88	28.15
0.0333	26.88	27.88
0.05	27.87	28.67
0.0666	25.02	28.8
0.0833	25.48	28.58
0.1	25.41	28.4
0.1166	24.63	28.25
0.1333	26.18	28.11
0.15	25.59	27.98
0.1666	26.09	27.86
0.1833	26.16	27.76
0.2	25.93	27.66
0.2166	26.03	27.58
0.2333	26.12	27.51
0.25	26.21	27.42
0.2666	26.27	27.36
0.2833	26.34	27.32
0.3	26.4	27.26
0.3166	26.46	27.22
0.3333	26.51	27.16
0.4167	27.07	27.02
0.5	27.03	26.95
0.5833	26.99	26.92
0.6667	26.96	26.9
0.75	26.89	26.89
0.8333	26.88	26.88
0.9167	26.87	26.88
1	26.89	26.88
1.0833	26.89	26.88
1.1667	26.89	26.88
1.25	26.89	26.88
1.3333	26.88	26.88

MW-30S
~~P-24S~~

Time	Slug In	Slug Out
1.4166	26.89	26.88
1.5	26.88	26.88
1.5833	26.89	26.88
1.6667	26.88	26.88
1.75	26.89	26.88
1.8333	26.88	26.88
1.9167	26.89	26.88
2	26.88	26.88
2.5	26.88	26.88
3	26.89	26.88
3.5	26.89	26.88
4	26.88	26.88
4.5	26.88	26.88
5	26.89	26.88
5.5	26.88	26.88
6	26.88	26.88
6.5	26.89	26.88
7	26.89	26.88
7.5	26.88	26.88
8	26.88	26.88
8.5	26.88	26.87
9	26.88	26.87
9.5	26.88	26.87
10	26.88	26.87
11	26.88	26.87
12	26.87	26.87
13	26.88	26.87
14	26.88	26.87
15	26.88	26.88
16	26.88	26.88
17	26.89	26.87
18	26.88	26.87
19	26.88	26.87
20	26.88	26.87
21	26.88	26.87
22	26.88	
23	26.88	
24	26.88	
25	26.88	
26	26.88	

SE1000B
Environmental Logger
10-Aug 8:15

~~P24~~ MW-30D (JH) 12/19/97

Unit# 331 Test# 5

INPUT 1:00 Level (F) TOC

Reference 25.24
Scale factor 9.97
Offset 0.03

Step# 0 9-Aug 12:08
Step# 1 9-Aug 12:20

MW-30D
~~P-24D~~

Time	Slug In	Slug Out
0	25.24	25.23
0.0033	25.24	25.23
0.0066	25.24	25.23
0.0099	25.24	25.23
0.0133	25.24	25.23
0.0166	25.24	25.23
0.02	25.24	25.23
0.0233	25.24	25.23
0.0266	25.24	25.23
0.03	25.23	25.23
0.0333	25.24	25.75
0.05	25.25	26.44
0.0666	25.22	27.54
0.0833	25.24	27.44
0.1	25.24	27.39
0.1166	24.76	27.34
0.1333	24.27	27.3
0.15	23.13	27.25
0.1666	23.43	27.21
0.1833	23.29	27.18
0.2	23.35	27.15
0.2166	23.52	27.11
0.2333	22.99	27.07
0.25	23.84	27.04
0.2666	23.72	27.01
0.2833	23.76	26.98
0.3	23.81	26.95
0.3166	23.79	26.92
0.3333	23.57	26.89
0.4167	23.21	26.76
0.5	23.48	26.64
0.5833	23.69	26.53
0.6667	23.8	26.44
0.75	23.92	26.35
0.8333	24.02	26.27
0.9167	24.11	26.19
1	24.2	26.12
1.0833	24.28	26.06
1.1667	24.35	26
1.25	24.42	25.95
1.3333	24.48	25.9

MW-30D
~~P-24D~~

Time	Slug In	Slug Out
1.4166	24.54	25.86
1.5	24.59	25.81
1.5833	24.64	25.77
1.6667	24.68	25.74
1.75	24.72	25.71
1.8333	24.76	25.68
1.9167	24.81	25.65
2	24.86	25.62
2.5	25.04	25.5
3	25.12	25.42
3.5	25.17	25.37
4	25.19	25.33
4.5	25.2	25.3
5	25.21	25.29
5.5	25.21	25.28
6	25.22	25.27
6.5	25.22	25.26
7	25.22	25.26
7.5	25.22	25.25
8	25.22	25.25
8.5	25.22	25.25
9	25.22	25.25
9.5	25.22	25.25
10	25.22	25.25
11	25.22	25.24
12		25.24
13		25.24
14		25.24
15		25.24
16		25.24
17		25.24
18		25.23
19		25.24
20		25.23
21		25.24
22		25.24
23		25.24
24		25.24
25		25.24
26		25.24
27		25.23

MW-30D
~~P-24D~~

Time	Slug In	Slug Out
28		25.23
29		25.23
30		25.23
31		25.23
32		25.24
33		25.24
34		25.24
35		25.24
36		25.24
37		25.24
38		25.22
39		25.23
40		25.23
41		25.23
42		25.22
43		25.22
44		25.22
45		25.22
46		25.22
47		25.22
48		25.23
49		25.26
50		25.28
51		25.29
52		25.29
53		25.29
54		25.28
55		25.26
56		25.25
57		25.27
58		25.28
59		25.26
60		25.25
61		25.24
62		25.24
63		25.24
64		25.24
65		25.24
66		25.24
67		25.25
68		25.24

MW-30D
~~P-24D~~

Time	Slug In	Slug Out
69		25.24
70		25.24
71		25.24
72		25.24
73		25.24
74		25.24
75		25.24
76		25.24
77		25.24
78		25.23
79		25.23
80		25.23
81		25.23
82		25.23
83		25.23
84		25.23
85		25.23
86		25.23
87		25.23
88		25.23
89		25.22
90		25.22
91		25.23
92		25.23
93		25.23
94		25.23
95		25.22
96		25.22
97		25.22
98		25.22
99		25.22

(JH) 12/19/97
~~000495~~

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/23/97 14:28:23

==

TEST DESCRIPTION

Data set........... MW31SI.DAT
Output file........ MW31SI.OUT
Data set title..... MW-31 SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/17/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 4.74
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 28.53
   Well screen length............... 10
   Static height of water in well... 28.53

```
   Gravel pack porosity............. 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.453
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 59

================================================================================
                              ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

================================================================================
                    RESULTS FROM STATISTICAL CURVE MATCHING


STATISTICAL MATCH PARAMETER ESTIMATES

           Estimate        Std.  Error
   K  =   3.3096E-004 +/-   7.1804E-006 ft/min
   y0 =   2.1626E+000 +/-   1.0013E-002 ft


ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals.............. 37
   Number of estimated parameters.... 2
   Degrees of freedom............... 35
   Residual mean.................... 0.0003265
   Residual standard deviation....... 0.03511
```

Residual variance................ 0.001232

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0666	2.13	2.1232	0.0067863	1
0.0833	2.18	2.1134	0.06656	1
0.1	2.16	2.1037	0.056289	1
0.1166	2.14	2.0941	0.045914	1
0.1333	2.13	2.0844	0.045554	1
0.15	2.11	2.0749	0.035149	1
0.1666	2.09	2.0654	0.024643	1
0.1833	2.07	2.0558	0.01415	1
0.2	2.06	2.0464	0.013614	1
0.2166	2.04	2.037	0.0029776	1
0.2333	2.03	2.0276	0.0023545	1
0.25	2.01	2.0183	-0.0083118	1
0.2666	2	2.0091	-0.0090766	1
0.2833	1.98	1.9998	-0.019828	1
0.3	1.97	1.9906	-0.020623	1
0.3166	1.96	1.9815	-0.021514	1
0.3333	1.94	1.9724	-0.032393	1
0.4167	1.89	1.9275	-0.037465	1
0.5	1.84	1.8836	-0.043613	1
0.5833	1.79	1.8408	-0.050759	1
0.6667	1.75	1.7988	-0.04883	1
0.75	1.71	1.7579	-0.047904	1
0.8333	1.67	1.7179	-0.04791	1
0.9167	1.64	1.6788	-0.038779	1
1	1.6	1.6406	-0.040585	1
1.0833	1.58	1.6033	-0.02326	1
1.1667	1.55	1.5667	-0.01674	1

1.25	1.52	1.5311	-0.011095	1
1.3333	1.49	1.4963	-0.0062609	1
1.4166	1.46	1.4622	-0.0022192	1
1.5	1.43	1.4289	0.0010875	1
1.5833	1.41	1.3964	0.013597	1
1.6667	1.39	1.3646	0.025404	1
1.75	1.37	1.3335	0.036451	1
1.8333	1.35	1.3032	0.04679	1
1.9167	1.32	1.2735	0.046475	1
2	1.3	1.2446	0.055449	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	3.3096E-004 ft/min
y0 =	2.1626E+000 ft

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                    A Q T E S O L V   R E S U L T S
                              Version 2.0

                     Developed by Glenn M. Duffield
                  (c) 1993, 1994 Geraghty & Miller, Inc.

10/23/97                                                                14:31:26

================================================================================
                              TEST DESCRIPTION

Data set........... MW31SO.DAT
Output file........ MW31SO.OUT
Data set title..... MW-31 SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/17/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 2.39
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 28.53
   Well screen length............... 10
   Static height of water in well... 28.53
```

Gravel pack porosity............. 0
Effective well casing radius..... 0.0833
Effective wellbore radius........ 0.25
Log(Re/Rw)....................... 3.453
Constants A, B and C............. 0.000 , 0.000, 2.297
No. of observations.............. 54

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	2.4175E-004	+/-	7.8019E-006 ft/min
y0 =	2.1438E+000	+/-	1.8732E-002 ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals.............. 36
Number of estimated parameters.... 2
Degrees of freedom............... 34
Residual mean.................... 0.002199
Residual standard deviation....... 0.06061

Residual variance................ 0.003673

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.2	2.15	2.059	0.091041	1
0.2166	2.13	2.0521	0.077927	1
0.2333	2.12	2.0452	0.074831	1
0.25	2.11	2.0383	0.071712	1
0.2666	2.09	2.0315	0.058529	1
0.2833	2.08	2.0246	0.055364	1
0.3	2.07	2.0178	0.052175	1
0.3166	2.05	2.0111	0.038924	1
0.3333	2.04	2.0043	0.03569	1
0.4167	1.98	1.9709	0.0091407	1
0.5	1.93	1.938	-0.0080057	1
0.5833	1.88	1.9057	-0.0257	1
0.6667	1.84	1.8739	-0.033895	1
0.75	1.8	1.8427	-0.042657	1
0.8333	1.76	1.8119	-0.051941	1
0.9167	1.73	1.7817	-0.0517	1
1	1.7	1.752	-0.052	1
1.0833	1.67	1.7228	-0.052795	1
1.1667	1.64	1.694	-0.054042	1
1.25	1.61	1.6658	-0.055803	1
1.3333	1.58	1.638	-0.058035	1
1.4166	1.55	1.6107	-0.060729	1
1.5	1.53	1.5838	-0.053847	1
1.5833	1.5	1.5574	-0.057445	1
1.6667	1.48	1.5315	-0.051452	1
1.75	1.46	1.5059	-0.045923	1
1.8333	1.43	1.4808	-0.05082	1

1.9167	1.41	1.4561	-0.046105	1
2	1.39	1.4318	-0.041833	1
2.5	1.27	1.2944	-0.024408	1
3	1.18	1.1702	0.0098261	1
3.5	1.09	1.0579	0.032137	1
4	1.02	0.95633	0.063668	1
4.5	0.95	0.86455	0.085455	1
5	0.89	0.78157	0.10843	1
5.5	0.84	0.70655	0.13345	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
K = 2.4175E-004 ft/min
y0 = 2.1438E+000 ft

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SE1000B
Environmental Logger
12-Aug 8:42

~~P-7~~ MW-32 JH 12/19/97

Unit# 331 Test# 2

INPUT 1:00 Level (F) TOC

Reference 18.79
Scale factor 9.97
Offset 0.03

Step# 0 10-Aug 13:28
Step# 1 10-Aug 14:18

MW-32
~~P-7~~

Time	Slug In	Slug Out
0	18.79	18.53
0.0033	18.79	18.53
0.0066	18.78	18.67
0.0099	18.79	18.92
0.0133	18.79	19.22
0.0166	18.78	19.26
0.02	18.36	19.31
0.0233	18.14	19.53
0.0266	17.62	19.83
0.03	17.36	20.08
0.0333	16.95	20.27
0.05	16.56	20.5
0.0666	16.76	20.41
0.0833	16.64	20.38
0.1	16.73	20.36
0.1166	16.75	20.34
0.1333	16.72	20.33
0.15	16.77	20.31
0.1666	16.78	20.3
0.1833	16.74	20.3
0.2	16.95	20.28
0.2166	16.81	20.24
0.2333	16.83	20.25
0.25	16.86	20.24
0.2666	16.86	20.23
0.2833	16.88	20.22
0.3	16.91	20.21
0.3166	16.9	20.19
0.3333	16.91	20.18
0.4167	16.98	20.14
0.5	17.03	20.1
0.5833	17.09	20.06
0.6667	17.13	20.03
0.75	17.18	19.99
0.8333	17.23	19.96
0.9167	17.27	19.93
1	17.31	19.9
1.0833	17.35	19.88
1.1667	17.39	19.85
1.25	17.43	19.82
1.3333	17.47	19.8
1.4166	17.5	19.77
1.5	17.53	19.75
1.5833	17.57	19.72
1.6667	17.59	19.7

MW-32
~~P-7~~

Time	Slug In	Slug Out
1.75	17.62	19.68
1.8333	17.65	19.65
1.9167	17.68	19.63
2	17.7	19.62
2.5	17.86	19.51
3	18	19.42
3.5	18.1	19.34
4	18.17	19.26
4.5	18.22	19.2
5	18.26	19.15
5.5	18.29	19.1
6	18.32	19.06
6.5	18.33	19.02
7	18.35	18.99
7.5	18.36	18.97
8	18.38	18.93
8.5	18.39	18.91
9	18.39	18.89
9.5	18.4	18.87
10	18.41	18.85
11	18.42	18.83
12	18.43	18.8
13	18.44	18.78
14	18.45	18.78
15	18.46	18.76
16	18.42	18.74
17	18.46	18.73
18	18.47	18.72
19	18.47	18.71
20	18.48	18.7
21	18.48	18.69
22	18.49	18.69
23	18.49	18.68
24	18.49	18.68
25	18.49	18.67
26	18.49	18.67
27	18.5	18.66
28	18.5	18.65
29	18.5	18.64
30	18.5	18.64
31	18.5	18.64
32	18.5	18.64
33	18.5	18.63
34	18.51	18.63
35	18.5	18.63

MW-32
~~P-7~~

Time	Slug In	Slug Out
36	18.51	18.63
37	18.51	18.63
38	18.51	18.63
39	18.51	18.63
40	18.51	18.63
41	18.51	18.62
42	18.51	18.62
43	18.51	18.62
44	18.51	18.62
45	18.51	18.61
46	18.52	18.61
47	18.52	18.61
48	18.52	18.61
49	18.53	18.61
50	18.53	18.6

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/24/97 17:47:26

==

TEST DESCRIPTION

Data set........... MW33ASI.DAT
Output file........ MW33ASI.TXT
Data set title..... MW-33A SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/23/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 3.27
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 33.33
   Well screen length............... 10
   Static height of water in well... 33.33

```
   Gravel pack porosity............ 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)...................... 3.543
   Constants A, B and C............ 0.000 ,  0.000,  2.297
   No. of observations............. 63

================================================================================
                                ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

================================================================================
                     RESULTS FROM STATISTICAL CURVE MATCHING


STATISTICAL MATCH PARAMETER ESTIMATES

           Estimate          Std.  Error
   K  =   4.1901E-004 +/-   1.7190E-005 ft/min
   y0 =   1.6283E+000 +/-   1.7949E-002 ft


ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals.............. 39
   Number of estimated parameters.... 2
   Degrees of freedom............... 37
   Residual mean.................... 0.0007539
   Residual standard deviation....... 0.06335
```

Residual variance................ 0.004013

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0666	1.63	1.5918	0.038224	1
0.0833	1.61	1.5827	0.02726	1
0.1	1.64	1.5738	0.066244	1
0.1166	1.61	1.5649	0.045123	1
0.1333	1.59	1.556	0.034006	1
0.15	1.43	1.5472	-0.11716	1
0.1666	1.85	1.5384	0.31157	1
0.1833	1.52	1.5297	-0.0097	1
0.2	1.51	1.521	-0.011017	1
0.2166	1.51	1.5124	-0.0024351	1
0.2333	1.49	1.5039	-0.01385	1
0.25	1.47	1.4953	-0.025314	1
0.2666	1.46	1.4869	-0.026877	1
0.2833	1.45	1.4784	-0.028437	1
0.3	1.44	1.47	-0.030045	1
0.3166	1.43	1.4618	-0.031751	1
0.3333	1.42	1.4535	-0.033454	1
0.4167	1.37	1.4127	-0.042717	1
0.5	1.33	1.3732	-0.043169	1
0.5833	1.29	1.3347	-0.044728	1
0.6667	1.26	1.2973	-0.037319	1
0.75	1.22	1.261	-0.041001	1
0.8333	1.19	1.2257	-0.0357	1
0.9167	1.16	1.1913	-0.031347	1
1	1.13	1.158	-0.027996	1
1.0833	1.1	1.1256	-0.025578	1
1.1667	1.07	1.094	-0.024031	1

1.25	1.05	1.0634	-0.013404	1
1.3333	1.03	1.0336	-0.003635	1
1.4166	1	1.0047	-0.004699	1
1.5	0.98	0.97654	0.0034602	1
1.5833	0.95	0.9492	0.00079786	1
1.6667	0.93	0.9226	0.0074016	1
1.75	0.91	0.89677	0.013229	1
1.8333	0.89	0.87167	0.018334	1
1.9167	0.87	0.84724	0.022764	1
2	0.85	0.82352	0.026482	1
2.5	0.75	0.69447	0.055526	1
3	0.65	0.58565	0.064349	1

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/24/97 17:48:08

==

TEST DESCRIPTION

Data set........... MW33ASO.DAT
Output file........ MW33ASO.TXT
Data set title..... MW-33A SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/23/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 2.09
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 33.33
   Well screen length............... 10
   Static height of water in well... 33.33

Gravel pack porosity............ 0
Effective well casing radius..... 0.0833
Effective wellbore radius........ 0.25
Log(Re/Rw)....................... 3.543
Constants A, B and C............. 0.000 , 0.000, 2.297
No. of observations.............. 69

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	3.7157E-004	+/-	9.4240E-006 ft/min
y0 =	1.6594E+000	+/-	1.0638E-002 ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 38
Number of estimated parameters.... 2
Degrees of freedom................ 36
Residual mean..................... 0.000661
Residual standard deviation....... 0.03689

Residual variance................ 0.001361

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0833	1.7	1.6182	0.08182	1
0.1	1.68	1.61	0.069968	1
0.1166	1.67	1.602	0.068027	1
0.1333	1.65	1.5939	0.056093	1
0.15	1.63	1.5859	0.044118	1
0.1666	1.61	1.5779	0.032056	1
0.1833	1.58	1.57	0.010001	1
0.2	1.56	1.5621	-0.0020936	1
0.2166	1.55	1.5543	-0.0042752	1
0.2333	1.53	1.5464	-0.016449	1
0.25	1.52	1.5387	-0.018663	1
0.2666	1.51	1.531	-0.020961	1
0.2833	1.5	1.5233	-0.023253	1
0.3	1.49	1.5156	-0.025583	1
0.3166	1.48	1.508	-0.027997	1
0.3333	1.47	1.5004	-0.030404	1
0.4167	1.43	1.4631	-0.033053	1
0.5	1.39	1.4267	-0.036675	1
0.5833	1.35	1.3912	-0.041201	1
0.6667	1.32	1.3566	-0.036568	1
0.75	1.29	1.3228	-0.032837	1
0.8333	1.25	1.2899	-0.039946	1
0.9167	1.22	1.2578	-0.037833	1
1	1.2	1.2266	-0.026558	1
1.0833	1.17	1.1961	-0.02606	1
1.1667	1.14	1.1663	-0.026285	1
1.25	1.12	1.1373	-0.017286	1

1.3333	1.1	1.109	-0.0090075	1
1.4166	1.07	1.0814	-0.011432	1
1.5	1.05	1.0545	-0.004511	1
1.5833	1.03	1.0283	0.001709	1
1.6667	1.01	1.0027	0.0073074	1
1.75	0.99	0.97776	0.012239	1
1.8333	0.97	0.95345	0.016551	1
1.9167	0.95	0.92971	0.020286	1
2	0.93	0.9066	0.023403	1
2.5	0.83	0.77943	0.05057	1
3	0.75	0.6701	0.079899	1

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/24/97 17:48:46

==
TEST DESCRIPTION

Data set........... MW33BSI.DAT
Output file........ MW33BSI.TXT
Data set title..... MW-33B SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/23/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 1.06
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 33.33
   Well screen length............... 10
   Static height of water in well... 33.33

```
   Gravel pack porosity............. 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.543
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 69
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
K =	2.6581E-004	+/-	7.7397E-006	ft/min
y0 =	6.7691E-001	+/-	5.2547E-003	ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 36
   Number of estimated parameters.... 2
   Degrees of freedom............... 34
   Residual mean.................... 0.0005759
   Residual standard deviation....... 0.017
```

Residual variance................ 0.0002888

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.1833	0.66	0.6506	0.0093996	1
0.2	0.68	0.64826	0.031745	1
0.2166	0.67	0.64593	0.024068	1
0.2333	0.66	0.6436	0.016396	1
0.25	0.66	0.64128	0.018716	1
0.2666	0.65	0.63899	0.011014	1
0.2833	0.65	0.63668	0.013317	1
0.3	0.64	0.63439	0.0056122	1
0.3166	0.64	0.63211	0.0078853	1
0.3333	0.64	0.62984	0.010164	1
0.4167	0.62	0.61858	0.0014207	1
0.5	0.6	0.60754	-0.0075367	1
0.5833	0.59	0.59669	-0.0066913	1
0.6667	0.58	0.58603	-0.0060268	1
0.75	0.56	0.57557	-0.015565	1
0.8333	0.55	0.56529	-0.015291	1
0.9167	0.54	0.55519	-0.015187	1
1	0.53	0.54528	-0.015276	1
1.0833	0.52	0.53554	-0.015542	1
1.1667	0.51	0.52597	-0.015971	1
1.25	0.5	0.51658	-0.016582	1
1.3333	0.49	0.50736	-0.01736	1
1.4166	0.48	0.4983	-0.018303	1
1.5	0.48	0.4894	-0.0093967	1
1.5833	0.47	0.48066	-0.01066	1
1.6667	0.46	0.47207	-0.01207	1
1.75	0.45	0.46364	-0.013642	1

1.8333	0.44	0.45537	-0.015366	1
1.9167	0.44	0.44723	-0.007227	1
2	0.43	0.43924	-0.0092434	1
2.5	0.39	0.39423	-0.0042298	1
3	0.36	0.35383	0.0061708	1
3.5	0.33	0.31757	0.012431	1
4	0.31	0.28502	0.024976	1
4.5	0.29	0.25582	0.034185	1
5	0.27	0.2296	0.040401	1

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A Q T E S O L V   R E S U L T S

Version 2.0

Developed by Glenn M. Duffield

10/23/97 14:11:49

==

TEST DESCRIPTION

Data set........... MW33BSO.DAT
Output file........ MW33BSO.OUT
Data set title..... MW-33B SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/23/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 0.84
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 33.33
   Well screen length............... 10
   Static height of water in well... 33.33

```
   Gravel pack porosity............ 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)...................... 3.543
   Constants A, B and C............ 0.000 ,  0.000,  2.297
   No. of observations............. 56
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
           Estimate          Std.  Error
   K  =   4.6318E-004 +/-   1.0875E-005 ft/min
   y0 =   5.9615E-001 +/-   4.3087E-003 ft
```

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 44
   Number of estimated parameters.... 2
   Degrees of freedom............... 42
   Residual mean.................... 0.0006397
   Residual standard deviation....... 0.01614
```

Residual variance................. 0.0002606

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.05	0.64	0.58503	0.054975	1
0.0666	0.62	0.58138	0.038622	1
0.0833	0.61	0.57773	0.032269	1
0.1	0.59	0.57411	0.015893	1
0.1166	0.58	0.57053	0.0094729	1
0.1333	0.59	0.56695	0.023052	1
0.15	0.57	0.56339	0.0066079	1
0.1666	0.56	0.55988	0.00012079	1
0.1833	0.55	0.55637	-0.0063673	1
0.2	0.55	0.55288	-0.0028774	1
0.2166	0.54	0.54943	-0.00943	1
0.2333	0.53	0.54598	-0.015984	1
0.25	0.53	0.54256	-0.012559	1
0.2666	0.53	0.53918	-0.0091759	1
0.2833	0.52	0.53579	-0.015794	1
0.3	0.52	0.53243	-0.012433	1
0.3166	0.51	0.52911	-0.019113	1
0.3333	0.51	0.52579	-0.015794	1
0.4167	0.49	0.50953	-0.019528	1
0.5	0.48	0.49378	-0.013784	1
0.5833	0.46	0.47853	-0.018526	1
0.6667	0.45	0.46372	-0.013723	1
0.75	0.44	0.44939	-0.009394	1
0.8333	0.42	0.43551	-0.015508	1
0.9167	0.41	0.42204	-0.012035	1
1	0.4	0.40899	-0.0089945	1
1.0833	0.39	0.39636	-0.0063568	1

1.1667	0.38	0.3841	-0.0040952	1
1.25	0.37	0.37223	-0.0022269	1
1.3333	0.36	0.36073	-0.00072529	1
1.4166	0.35	0.34958	0.00042091	1
1.5	0.34	0.33876	0.0012355	1
1.5833	0.33	0.3283	0.0017031	1
1.6667	0.32	0.31814	0.0018592	1
1.75	0.31	0.30831	0.0016896	1
1.8333	0.3	0.29878	0.0012162	1
1.9167	0.29	0.28954	0.00045936	1
2	0.29	0.28059	0.009406	1
2.5	0.24	0.23241	0.0075878	1
3	0.21	0.1925	0.017496	1
3.5	0.17	0.15945	0.010552	1
4	0.15	0.13207	0.017931	1
4.5	0.12	0.10939	0.010609	1
5	0.1	0.090607	0.0093931	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate

K = 4.6318E-004 ft/min

y0 = 5.9615E-001 ft

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SE1000B
Environmental Logger
12-Aug 8:46

~~P6S~~ MW-34S JH 12/19/97

Unit# 331 Test# 3

INPUT 1:00 Level (F) TOC

Reference 6.44
Scale factor 9.97
Offset 0.03

Step# 0 10-Aug 15:27
Step# 1 10-Aug 15:58

MW-34S ~~P6S~~			MW-34S ~~P6S~~			MW-34S ~~P6S~~		
Time	Slug In	Slug Out	Time	Slug In	Slug Out	Time	Slug In	Slug Out
0	6.46	6.49	1.6667	6.16	6.8	34		6.51
0.0033	6.46	6.64	1.75	6.18	6.79	35		6.51
0.0066	6.46	7.35	1.8333	6.21	6.78	36		6.5
0.0099	6.47	6.86	1.9167	6.19	6.78	37		6.5
0.0133	6.21	6.03	2	6.2	6.77	38		6.5
0.0166	5.83	5.87	2.5	6.23	6.74	39		6.5
0.02	5.92	8.17	3	6.25	6.72	40		6.5
0.0233	5.33	6.79	3.5	6.28	6.69	41		6.5
0.0266	4.97	6.21	4	6.29	6.67	42		6.5
0.03	4.29	7.15	4.5	6.31	6.66	43		6.5
0.0333	4.26	6.75	5	6.32	6.65	44		6.5
0.05	4.31	8.06	5.5	6.32	6.64	45		6.5
0.0666	4.97	8.52	6	6.33	6.63			
0.0833	5.53	8.25	6.5	6.34	6.62			
0.1	5.2	8.02	7	6.36	6.61			
0.1166	5.21	7.87	7.5	6.36	6.61			
0.1333	5.29	7.75	8	6.37	6.6			
0.15	5.37	7.61	8.5	6.38	6.59			
0.1666	5.44	7.56	9	6.38	6.59			
0.1833	5.49	7.51	9.5	6.38	6.58			
0.2	5.53	7.46	10	6.38	6.58			
0.2166	5.55	7.41	11	6.4	6.57			
0.2333	5.62	7.37	12	6.41	6.56			
0.25	5.62	7.34	13	6.41	6.55			
0.2666	5.64	7.3	14	6.42	6.55			
0.2833	5.69	7.28	15	6.43	6.55			
0.3	5.71	7.25	16	6.43	6.54			
0.3166	5.75	7.23	17	6.43	6.54			
0.3333	5.76	7.21	18	6.44	6.53			
0.4167	5.79	7.13	19	6.44	6.53			
0.5	5.87	7.07	20	6.45	6.53			
0.5833	5.92	7.03	21	6.45	6.53			
0.6667	5.94	7	22	6.45	6.52			
0.75	5.97	6.97	23	6.45	6.52			
0.8333	6.01	6.94	24	6.46	6.52			
0.9167	6.04	6.92	25	6.46	6.52			
1	6.06	6.9	26	6.46	6.51			
1.0833	6.08	6.88	27	6.46	6.51			
1.1667	6.09	6.87	28	6.46	6.51			
1.25	6.11	6.85	29	6.46	6.51			
1.3333	6.12	6.84	30	6.46	6.51			
1.4166	6.14	6.83	31	6.46	6.51			
1.5	6.15	6.82	32		6.51			
1.5833	6.16	6.81	33		6.51			

SE1000B
Environmental Logger
17-Oct 8:19

~~P-6D~~ MW-34D JH 2/19/97

Unit# 331 Test# 3

INPUT 1:00 Level (F) TOC

Reference 12.73
Scale factor 9.97
Offset 0.03

Step# 0 14-Oct 8:39
Step# 1 14-Oct 11:57

MW-34D
~~P-6D~~

Time	Slug In	Slug Out
0	12.72	11.57
0.0033	12.72	11.57
0.0066	12.72	11.93
0.0099	12.72	13.24
0.0133	12.71	13.56
0.0166	12.7	13.25
0.02		13.46
0.0233	12.24	12.72
0.0266	11.07	12.76
0.03	11.41	12.51
0.0333	11.58	12.66
0.05	11.66	12.72
0.0666	11.61	12.73
0.0833	11.59	12.72
0.1	11.57	12.71
0.1166	11.59	12.7
0.1333	11.64	12.63
0.15	11.61	12.7
0.1666	11.64	12.69
0.1833	11.61	12.69
0.2	11.62	12.69
0.2166	11.62	12.69
0.2333	11.62	12.69
0.25	11.62	12.69
0.2666	11.62	12.69
0.2833	11.62	12.69
0.3	11.62	12.69
0.3166	11.62	12.68
0.3333	11.62	12.68
0.4167	11.62	12.68
0.5	11.62	12.68
0.5833	11.62	12.68
0.6667	11.63	12.68
0.75	11.62	12.68
0.8333	11.62	12.68
0.9167	11.62	12.68
1	11.62	12.68
1.0833	11.62	12.68
1.1667	11.62	12.68
1.25	11.62	12.68
1.3333	11.62	12.68
1.4166	11.62	12.68
1.5	11.62	12.68

MW-34D
~~P-6D~~

Time	Slug In	Slug Out
1.5833	11.62	12.68
1.6667	11.62	12.68
1.75	11.62	12.68
1.8333	11.62	12.68
1.9167	11.62	12.68
2	11.62	12.68
2.5	11.62	12.67
3	11.62	12.67
3.5	11.62	12.67
4	11.62	12.67
4.5	11.62	12.67
5	11.62	12.67
5.5	11.62	12.67
6	11.62	12.67
6.5	11.62	12.67
7	11.62	12.67
7.5	11.62	12.67
8	11.62	12.67
8.5	11.62	12.67
9	11.62	12.67
9.5	11.62	12.67
10	11.62	12.67
12	11.62	12.67
14	11.62	12.67
16	11.62	12.67
18	11.62	12.67
20	11.62	12.67
22	11.62	12.67
24	11.62	12.67
26	11.62	12.67
28	11.61	12.67
30	11.61	12.67
32	11.61	12.67
34	11.61	12.67
36	11.61	12.66
38	11.61	12.67
40	11.61	12.66
42	11.61	12.66
44	11.61	12.66
46	11.61	12.66
48	11.61	12.66
50	11.61	12.66
52	11.61	12.66

MW-34D
~~P-6D~~

Time	Slug In	Slug Out
54	11.61	12.66
56	11.61	12.66
58	11.61	12.66
60	11.61	12.66
62	11.6	12.66
64	11.6	12.66
66	11.6	12.66
68	11.6	12.66
70	11.6	12.65
72	11.6	12.66
74	11.6	12.66
76	11.6	12.66
78	11.6	12.6[illegible]
80	11.6	12.6[illegible]
82	11.6	12.65
84	11.6	12.65
86	11.6	12.65
88	11.6	12.65
90	11.6	12.65
92	11.6	12.65
94	11.6	12.65
96	11.6	12.65
98	11.6	12.65
100	11.59	12.65
110	11.59	12.64
120	11.59	12.64
130	11.58	12.64
140	11.58	12.64
150	11.58	12.63
160	11.58	12.63
170	11.58	12.63
180	11.58	12.63
190	11.57	12.62
200		12.62
210		12.62
220		12.61
230		12.61
240		12.61

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A Q T E S O L V   R E S U L T S

Version 2.0

Developed by Glenn M. Duffield

10/23/97 15:30:05

==

TEST DESCRIPTION

Data set........... MW35SI.DAT
Output file........ MW35AQSI.OUT
Data set title..... MW-35A SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 9/03/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 1.46
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 24.58
   Well screen length............... 10
   Static height of water in well... 24.58

```
   Gravel pack porosity............ 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)...................... 3.365
   Constants A, B and C............ 0.000 ,  0.000,  2.297
   No. of observations............. 200
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
          Estimate          Std.  Error
   K  =   2.0390E-007 +/-   4.4986E-009 ft/min
   y0 =   1.0107E+000 +/-   3.1608E-004 ft
```

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 194
   Number of estimated parameters.... 2
   Degrees of freedom............... 192
   Residual mean.................... -2.936E-009
   Residual standard deviation....... 0.002718
```

Residual variance................ 7.39E-006

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.1666	1.01	1.0107	-0.00065113	1
0.1833	1.01	1.0106	-0.00064819	1
0.2	1.01	1.0106	-0.00064524	1
0.2166	1.01	1.0106	-0.00064231	1
0.2333	1.01	1.0106	-0.00063936	1
0.25	1.01	1.0106	-0.00063641	1
0.2666	1.01	1.0106	-0.00063348	1
0.2833	1.01	1.0106	-0.00063054	1
0.3	1.01	1.0106	-0.00062759	1
0.3166	1.01	1.0106	-0.00062466	1
0.3333	1.01	1.0106	-0.00062171	1
0.4167	1.01	1.0106	-0.00060699	1
0.5	1.01	1.0106	-0.00059229	1
0.5833	1.01	1.0106	-0.00057759	1
0.6667	1.01	1.0106	-0.00056287	1
0.75	1.01	1.0105	-0.00054817	1
0.8333	1.01	1.0105	-0.00053346	1
0.9167	1.01	1.0105	-0.00051875	1
1	1.01	1.0105	-0.00050405	1
1.0833	1.01	1.0105	-0.00048934	1
1.1667	1.01	1.0105	-0.00047463	1
1.25	1.01	1.0105	-0.00045993	1
1.3333	1.01	1.0104	-0.00044523	1
1.4166	1.01	1.0104	-0.00043053	1
1.5	1.01	1.0104	-0.00041581	1
1.5833	1.01	1.0104	-0.00040111	1
1.6667	1.01	1.0104	-0.00038639	1

1.75	1.01	1.0104	-0.00037169	1
1.8333	1.01	1.0104	-0.00035699	1
1.9167	1.01	1.0103	-0.00034228	1
2	1.01	1.0103	-0.00032758	1
2.5	1.01	1.0102	-0.00023936	1
3	1.01	1.0102	-0.00015115	1
3.5	1.01	1.0101	-6.294E-005	1
4	1.01	1.01	2.5258E-005	1
4.5	1.01	1.0099	0.00011345	1
5	1.01	1.0098	0.00020163	1
5.5	1.01	1.0097	0.00028981	1
6	1.01	1.0096	0.00037797	1
6.5	1.01	1.0095	0.00046613	1
7	1.01	1.0094	0.00055428	1
7.5	1.01	1.0094	0.00064243	1
8	1.01	1.0093	0.00073056	1
8.5	1.01	1.0092	0.00081869	1
9	1.01	1.0091	0.00090681	1
9.5	1.01	1.009	0.00099493	1
10	1.01	1.0089	0.001083	1
11	1.01	1.0087	0.0012592	1
12	1.01	1.0086	0.0014354	1
13	1.01	1.0084	0.0016115	1
14	1.01	1.0082	0.0017876	1
15	1.01	1.008	0.0019637	1
16	1.01	1.0079	0.0021397	1
17	1.01	1.0077	0.0023157	1
18	1.01	1.0075	0.0024917	1
19	1.01	1.0073	0.0026676	1
20	1.01	1.0072	0.0028435	1
21	1.01	1.007	0.0030194	1
22	1.01	1.0068	0.0031953	1
23	1.01	1.0066	0.0033711	1
24	1.01	1.0065	0.0035469	1

25	1.01	1.0063	0.0037226	1
26	1.01	1.0061	0.0038984	1
27	1.01	1.0059	0.0040741	1
28	1.01	1.0058	0.0042497	1
29	1	1.0056	-0.0055746	1
30	1	1.0054	-0.005399	1
31	1.01	1.0052	0.0047765	1
32	1.01	1.005	0.0049521	1
33	1	1.0049	-0.0048724	1
34	1	1.0047	-0.0046969	1
35	1	1.0045	-0.0045215	1
36	1	1.0043	-0.0043461	1
37	1	1.0042	-0.0041707	1
38	1	1.004	-0.0039953	1
39	1	1.0038	-0.00382	1
40	1	1.0036	-0.0036447	1
41	1	1.0035	-0.0034694	1
42	1	1.0033	-0.0032942	1
43	1	1.0031	-0.003119	1
44	1	1.0029	-0.0029438	1
45	1	1.0028	-0.0027687	1
46	1	1.0026	-0.0025935	1
47	1	1.0024	-0.0024185	1
48	1	1.0022	-0.0022434	1
49	1	1.0021	-0.0020684	1
50	1	1.0019	-0.0018934	1
51	1	1.0017	-0.0017184	1
52	1	1.0015	-0.0015435	1
53	1	1.0014	-0.0013686	1
54	1	1.0012	-0.0011937	1
55	1	1.001	-0.0010189	1
56	1	1.0008	-0.00084408	1
57	1	1.0007	-0.0006693	1
58	1	1.0005	-0.00049455	1

59	1	1.0003	-0.00031983	1
60	1	1.0001	-0.00014515	1
61	1	0.99997	2.9509E-005	1
62	1	0.9998	0.00020413	1
63	1	0.99962	0.00037873	1
64	1	0.99945	0.00055329	1
65	1	0.99927	0.00072783	1
66	1	0.9991	0.00090233	1
67	1	0.99892	0.0010768	1
68	1	0.99875	0.0012512	1
69	1	0.99857	0.0014257	1
70	1	0.9984	0.0016	1
71	1	0.99823	0.0017744	1
72	1	0.99805	0.0019487	1
73	1	0.99788	0.002123	1
74	1	0.9977	0.0022973	1
75	1	0.99753	0.0024715	1
76	1	0.99735	0.0026457	1
77	1	0.99718	0.0028199	1
78	1	0.99701	0.002994	1
79	1	0.99683	0.0031681	1
80	1	0.99666	0.0033422	1
81	1	0.99648	0.0035162	1
82	1	0.99631	0.0036903	1
83	1	0.99614	0.0038642	1
84	1	0.99596	0.0040382	1
85	1	0.99579	0.0042121	1
86	1	0.99561	0.004386	1
87	1	0.99544	0.0045599	1
88	1	0.99527	0.0047337	1
89	1	0.99509	0.0049075	1
90	1	0.99492	0.0050813	1
91	0.99	0.99474	-0.004745	1
92	0.99	0.99457	-0.0045712	1

93	0.99	0.9944	-0.0043976	1
94	0.99	0.99422	-0.0042239	1
95	0.99	0.99405	-0.0040503	1
96	0.99	0.99388	-0.0038767	1
97	0.99	0.9937	-0.0037031	1
98	0.99	0.99353	-0.0035296	1
99	0.99	0.99336	-0.0033561	1
100	0.99	0.99318	-0.0031826	1
101	0.99	0.99301	-0.0030092	1
102	0.99	0.99284	-0.0028358	1
103	0.99	0.99266	-0.0026624	1
104	0.99	0.99249	-0.0024891	1
105	0.99	0.99232	-0.0023157	1
106	0.99	0.99214	-0.0021424	1
107	0.99	0.99197	-0.0019692	1
108	0.99	0.9918	-0.001796	1
109	0.99	0.99162	-0.0016228	1
110	0.99	0.99145	-0.0014496	1
111	0.99	0.99128	-0.0012765	1
112	0.99	0.9911	-0.0011033	1
113	0.99	0.99093	-0.00093027	1
114	0.99	0.99076	-0.00075722	1
115	0.99	0.99058	-0.00058421	1
116	0.99	0.99041	-0.00041122	1
117	0.99	0.99024	-0.00023826	1
118	0.99	0.99007	-6.5338E-005	1
119	0.99	0.98989	0.00010756	1
120	0.99	0.98972	0.00028042	1
121	0.99	0.98955	0.00045326	1
122	0.99	0.98937	0.00062607	1
123	0.99	0.9892	0.00079884	1
124	0.99	0.98903	0.00097159	1
125	0.99	0.98886	0.0011443	1
126	0.99	0.98868	0.001317	1

127	0.99	0.98851	0.0014896	1
128	0.99	0.98834	0.0016623	1
129	0.99	0.98817	0.0018349	1
130	0.99	0.98799	0.0020074	1
131	0.99	0.98782	0.00218	1
132	0.99	0.98765	0.0023525	1
133	0.99	0.98748	0.0025249	1
134	0.99	0.9873	0.0026974	1
135	0.99	0.98713	0.0028698	1
136	0.99	0.98696	0.0030422	1
137	0.99	0.98679	0.0032145	1
138	0.99	0.98661	0.0033869	1
139	0.99	0.98644	0.0035591	1
140	0.99	0.98627	0.0037314	1
141	0.99	0.9861	0.0039036	1
142	0.99	0.98592	0.0040758	1
143	0.99	0.98575	0.004248	1
144	0.99	0.98558	0.0044202	1
145	0.98	0.98541	-0.0054077	1
146	0.98	0.98524	-0.0052356	1
147	0.99	0.98506	0.0049364	1
148	0.99	0.98489	0.0051084	1
149	0.98	0.98472	-0.0047196	1
150	0.98	0.98455	-0.0045476	1
151	0.98	0.98438	-0.0043757	1
152	0.98	0.9842	-0.0042038	1
153	0.98	0.98403	-0.0040319	1
154	0.98	0.98386	-0.0038601	1
155	0.98	0.98369	-0.0036883	1
156	0.98	0.98352	-0.0035165	1
157	0.98	0.98334	-0.0033447	1

==

RESULTS FROM VISUAL CURVE MATCHING

```
VISUAL MATCH PARAMETER ESTIMATES

           Estimate
   K  =   2.0390E-007 ft/min
   y0 =   1.0107E+000 ft
```

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A Q T E S O L V   R E S U L T S
Version 2.0

Developed by Glenn M. Duffield

10/24/97 17:05:34

==

TEST DESCRIPTION

Data set........... MW35SO.DAT
Output file........ MW35SO.OUT
Data set title..... MW-35A SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 9/04/97

Units of Measurement
Length.......... ft
Time............ min

Test Well Data
Initial displacement in well..... 2.3
Radius of well casing........... 0.0833
Radius of wellbore.............. 0.25
Aquifer saturated thickness...... 24.58
Well screen length.............. 10
Static height of water in well... 24.58

```
   Gravel pack porosity............ 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.365
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 200
```

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
           Estimate          Std.  Error
   K  =   7.9213E-008 +/-    1.3926E-008 ft/min
   y0 =   9.7761E-001 +/-    8.8735E-004 ft
```

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:

```
   Number of residuals.............. 191
   Number of estimated parameters.... 2
   Degrees of freedom............... 189
   Residual mean.................... 1.544E-008
   Residual standard deviation....... 0.007799
```

Residual variance................ 6.083E-005

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0833	1.05	0.9776	0.072396	1
0.1	1.03	0.9776	0.052397	1
0.1166	0.98	0.9776	0.0023977	1
0.1333	0.97	0.9776	-0.0076012	1
0.15	0.98	0.9776	0.0023999	1
0.1666	0.99	0.9776	0.012401	1
0.1833	0.99	0.9776	0.012402	1
0.2	0.98	0.9776	0.0024033	1
0.2166	0.98	0.9776	0.0024044	1
0.2333	0.98	0.97759	0.0024055	1
0.25	0.98	0.97759	0.0024066	1
0.2666	0.98	0.97759	0.0024077	1
0.2833	0.98	0.97759	0.0024088	1
0.3	0.98	0.97759	0.0024099	1
0.3166	0.98	0.97759	0.002411	1
0.3333	0.98	0.97759	0.0024121	1
0.4167	0.98	0.97758	0.0024176	1
0.5	0.98	0.97758	0.0024231	1
0.5833	0.98	0.97757	0.0024287	1
0.6667	0.98	0.97757	0.0024342	1
0.75	0.98	0.97756	0.0024397	1
0.8333	0.98	0.97755	0.0024453	1
0.9167	0.98	0.97755	0.0024508	1
1	0.98	0.97754	0.0024563	1
1.0833	0.98	0.97754	0.0024618	1
1.1667	0.98	0.97753	0.0024674	1
1.25	0.98	0.97753	0.0024729	1

1.3333	0.98	0.97752	0.0024784	1
1.4166	0.98	0.97752	0.0024839	1
1.5	0.98	0.97751	0.0024895	1
1.5833	0.98	0.97751	0.002495	1
1.6667	0.98	0.9775	0.0025005	1
1.75	0.98	0.97749	0.0025061	1
1.8333	0.98	0.97749	0.0025116	1
1.9167	0.98	0.97748	0.0025171	1
2	0.98	0.97748	0.0025226	1
2.5	0.98	0.97744	0.0025558	1
3	0.98	0.97741	0.0025889	1
3.5	0.98	0.97738	0.0026221	1
4	0.98	0.97734	0.0026553	1
4.5	0.98	0.97731	0.0026884	1
5	0.98	0.97728	0.0027216	1
5.5	0.98	0.97725	0.0027547	1
6	0.98	0.97721	0.0027879	1
6.5	0.98	0.97718	0.002821	1
7	0.98	0.97715	0.0028542	1
7.5	0.98	0.97711	0.0028873	1
8	0.98	0.97708	0.0029205	1
8.5	0.98	0.97705	0.0029536	1
9	0.97	0.97701	-0.0070133	1
9.5	0.97	0.97698	-0.0069801	1
10	0.97	0.97695	-0.006947	1
11	0.98	0.97688	0.0031193	1
12	0.97	0.97681	-0.0068144	1
13	0.97	0.97675	-0.0067481	1
14	0.97	0.97668	-0.0066819	1
15	0.97	0.97662	-0.0066156	1
16	0.97	0.97655	-0.0065494	1
17	0.97	0.97648	-0.0064831	1
18	0.97	0.97642	-0.0064169	1
19	0.97	0.97635	-0.0063506	1

20	0.97	0.97628	-0.0062844	1
21	0.97	0.97622	-0.0062181	1
22	0.97	0.97615	-0.0061519	1
23	0.97	0.97609	-0.0060857	1
24	0.97	0.97602	-0.0060195	1
25	0.97	0.97595	-0.0059532	1
26	0.97	0.97589	-0.005887	1
27	0.97	0.97582	-0.0058208	1
28	0.97	0.97575	-0.0057546	1
29	0.97	0.97569	-0.0056884	1
30	0.97	0.97562	-0.0056222	1
31	0.97	0.97556	-0.005556	1
32	0.97	0.97549	-0.0054898	1
33	0.97	0.97542	-0.0054237	1
34	0.97	0.97536	-0.0053575	1
35	0.97	0.97529	-0.0052913	1
36	0.97	0.97523	-0.0052251	1
37	0.97	0.97516	-0.005159	1
38	0.97	0.97509	-0.0050928	1
39	0.97	0.97503	-0.0050267	1
40	0.97	0.97496	-0.0049605	1
41	0.97	0.97489	-0.0048944	1
42	0.97	0.97483	-0.0048282	1
43	0.97	0.97476	-0.0047621	1
44	0.97	0.9747	-0.004696	1
45	0.97	0.97463	-0.0046298	1
46	0.97	0.97456	-0.0045637	1
47	0.97	0.9745	-0.0044976	1
48	0.97	0.97443	-0.0044315	1
49	0.97	0.97437	-0.0043654	1
50	0.97	0.9743	-0.0042993	1
51	0.97	0.97423	-0.0042332	1
52	0.97	0.97417	-0.0041671	1
53	0.97	0.9741	-0.004101	1

54	0.97	0.97403	-0.0040349	1
55	0.97	0.97397	-0.0039688	1
56	0.97	0.9739	-0.0039027	1
57	0.97	0.97384	-0.0038367	1
58	0.97	0.97377	-0.0037706	1
59	0.97	0.9737	-0.0037045	1
60	0.97	0.97364	-0.0036385	1
61	0.97	0.97357	-0.0035724	1
62	0.97	0.97351	-0.0035064	1
63	0.97	0.97344	-0.0034403	1
64	0.97	0.97337	-0.0033743	1
65	0.97	0.97331	-0.0033082	1
66	0.97	0.97324	-0.0032422	1
67	0.97	0.97318	-0.0031762	1
68	0.97	0.97311	-0.0031101	1
69	0.97	0.97304	-0.0030441	1
70	0.97	0.97298	-0.0029781	1
71	0.97	0.97291	-0.0029121	1
72	0.97	0.97285	-0.0028461	1
73	0.97	0.97278	-0.0027801	1
74	0.97	0.97271	-0.0027141	1
75	0.97	0.97265	-0.0026481	1
76	0.97	0.97258	-0.0025821	1
77	0.97	0.97252	-0.0025161	1
78	0.97	0.97245	-0.0024502	1
79	0.97	0.97238	-0.0023842	1
80	0.97	0.97232	-0.0023182	1
81	0.97	0.97225	-0.0022522	1
82	0.97	0.97219	-0.0021863	1
83	0.97	0.97212	-0.0021203	1
84	0.97	0.97205	-0.0020544	1
85	0.97	0.97199	-0.0019884	1
86	0.97	0.97192	-0.0019225	1
87	0.97	0.97186	-0.0018565	1

88	0.97	0.97179	-0.0017906	1
89	0.97	0.97172	-0.0017247	1
90	0.97	0.97166	-0.0016587	1
91	0.97	0.97159	-0.0015928	1
92	0.97	0.97153	-0.0015269	1
93	0.97	0.97146	-0.001461	1
94	0.97	0.9714	-0.0013951	1
95	0.97	0.97133	-0.0013292	1
96	0.97	0.97126	-0.0012633	1
97	0.97	0.9712	-0.0011974	1
98	0.97	0.97113	-0.0011315	1
99	0.97	0.97107	-0.0010656	1
100	0.97	0.971	-0.00099973	1
101	0.97	0.97093	-0.00093386	1
102	0.97	0.97087	-0.00086799	1
103	0.97	0.9708	-0.00080212	1
104	0.97	0.97074	-0.00073625	1
105	0.97	0.97067	-0.0006704	1
106	0.97	0.9706	-0.00060454	1
107	0.97	0.97054	-0.00053869	1
108	0.97	0.97047	-0.00047285	1
109	0.97	0.97041	-0.00040701	1
110	0.97	0.97034	-0.00034117	1
111	0.97	0.97028	-0.00027534	1
112	0.97	0.97021	-0.00020951	1
113	0.97	0.97014	-0.00014369	1
114	0.97	0.97008	-7.7869E-005	1
115	0.97	0.97001	-1.2055E-005	1
116	0.97	0.96995	5.3755E-005	1
117	0.97	0.96988	0.00011956	1
118	0.97	0.96981	0.00018536	1
119	0.97	0.96975	0.00025116	1
120	0.97	0.96968	0.00031695	1
121	0.97	0.96962	0.00038274	1

122	0.97	0.96955	0.00044852	1
123	0.97	0.96949	0.0005143	1
124	0.97	0.96942	0.00058007	1
125	0.97	0.96935	0.00064584	1
126	0.97	0.96929	0.0007116	1
127	0.98	0.96922	0.010777	1
128	0.97	0.96916	0.00084312	1
129	0.97	0.96909	0.00090887	1
130	0.98	0.96903	0.010975	1
131	0.97	0.96896	0.0010404	1
132	0.97	0.96889	0.0011061	1
133	0.97	0.96883	0.0011718	1
134	0.98	0.96876	0.011238	1
135	0.98	0.9687	0.011303	1
136	0.98	0.96863	0.011369	1
137	0.97	0.96857	0.0014347	1
138	0.97	0.9685	0.0015004	1
139	0.97	0.96843	0.0015661	1
140	0.97	0.96837	0.0016318	1
141	0.97	0.9683	0.0016975	1
142	0.98	0.96824	0.011763	1
143	0.98	0.96817	0.011829	1
144	0.97	0.96811	0.0018946	1
145	0.97	0.96804	0.0019603	1
146	0.97	0.96797	0.002026	1
147	0.97	0.96791	0.0020916	1
148	0.98	0.96784	0.012157	1
149	0.97	0.96778	0.002223	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

```
          Estimate
K   =   7.9213E-008 ft/min
y0 =   9.7761E-001 ft
```

```
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```

SE1000B
Environmental Logger
17-Oct 11:27

P-5 MW-36 (JH) 12/19/97

Unit#	331	Test#		1
INPUT	1:00	Level	(F)	TOC
Reference	2.5			
Scale factor	9.97			
Offset	0.03			
Step#	0	10-Oct	15:00	
Step#	1	10-Oct	15:13	

P-5 MW-36

Time	Slug In	Slug Out
0	2.36	2.12
0.0033	2.36	2.09
0.0066	2.36	2.1
0.0099	2.36	2.11
0.0133	2.36	2.45
0.0166	2.32	2.02
0.02	2.31	3.54
0.0233	2.35	4.27
0.0266	2.3	4.89
0.03	2.36	4.84
0.0333	2.24	5.25
0.05	2.18	4.9
0.0666	2.05	4.22
0.0833	1.53	4.26
0.1	1.3	4.14
0.1166	1.15	4.06
0.1333	1.04	4.04
0.15	0.69	3.95
0.1666	0.45	3.96
0.1833	0.03	3.89
0.2	0.12	3.82
0.2166	0.2	3.72
0.2333	0.29	3.67
0.25	0.37	3.61
0.2666	0.44	3.55
0.2833	0.51	3.5
0.3	0.57	3.46
0.3166	0.64	3.41
0.3333	0.69	3.37
0.4167	0.94	3.2
0.5	1.12	3.07
0.5833	1.26	2.94
0.6667	1.37	2.83
0.75	1.46	2.69
0.8333	1.54	2.6
0.9167	1.61	2.55
1	1.67	2.5
1.0833	1.71	2.45
1.1667	1.75	2.41
1.25	1.8	2.38
1.3333	1.83	2.34
1.4166	1.86	2.32
1.5	1.89	2.29
1.5833	1.91	2.27
1.6667	1.94	2.25

P-5 MW-36

Time	Slug In	Slug Out
1.75	1.96	2.23
1.8333	1.98	2.21
1.9167	1.99	2.2
2	2.01	2.18
2.5	2.07	2.11
3	2.11	2.07
3.5	2.13	2.04
4	2.14	2.01
4.5	2.15	1.99
5	2.15	1.98
5.5	2.15	1.96
6	2.15	1.95
6.5	2.15	1.93
7	2.15	1.92
7.5	2.14	1.92
8	2.14	1.91
8.5	2.14	1.9
9	2.14	1.9
9.5	2.14	1.89
10	2.14	1.88
11	2.15	1.87
12	2.14	1.86
13		1.86
14		1.85
15		1.84
16		1.85
17		1.84
18		1.84
19		1.83
20		1.81
21		1.81
22		1.81

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A Q T E S O L V   R E S U L T S

Version 2.0

Developed by Glenn M. Duffield

10/24/97 17:13:59

==

TEST DESCRIPTION

Data set........... MW37SI.DAT
Output file........ MW37SI.OUT
Data set title..... MW-37 SLUG IN
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/16/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 2.62
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 26.41
   Well screen length............... 10
   Static height of water in well... 26.41

Gravel pack porosity............. 0
Effective well casing radius..... 0.0833
Effective wellbore radius........ 0.25
Log(Re/Rw)....................... 3.408
Constants A, B and C............. 0.000 , 0.000, 2.297
No. of observations.............. 34

==

ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	4.3995E-003	+/-	2.2436E-005 ft/min
y0 =	2.6930E+000	+/-	9.1606E-003 ft

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals.............. 20
Number of estimated parameters.... 2
Degrees of freedom............... 18
Residual mean.................... -0.0009125
Residual standard deviation....... 0.009221

Residual variance................ 8.502E-005

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0666	2.09	2.1019	-0.011863	1
0.0833	1.97	1.9752	-0.0052147	1
0.1	1.85	1.8562	-0.006198	1
0.1166	1.74	1.745	-0.0050019	1
0.1333	1.64	1.6399	0.00014339	1
0.15	1.55	1.541	0.0089531	1
0.1666	1.46	1.4487	0.01127	1
0.1833	1.37	1.3614	0.0085633	1
0.2	1.29	1.2794	0.010597	1
0.2166	1.21	1.2028	0.0072399	1
0.2333	1.13	1.1303	-0.0002877	1
0.25	1.07	1.0622	0.0078179	1
0.2666	1	0.99855	0.0014482	1
0.2833	0.94	0.93838	0.0016161	1
0.3	0.88	0.88184	-0.0018415	1
0.3166	0.83	0.82901	0.00098546	1
0.3333	0.78	0.77906	0.0009378	1
0.4167	0.56	0.57119	-0.011194	1
0.5	0.4	0.41894	-0.018945	1
0.5833	0.29	0.30728	-0.017277	1

===

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
K =   4.3995E-003 ft/min
y0 =   2.6930E+000 ft

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                      A Q T E S O L V   R E S U L T S
                               Version 2.0

                      Developed by Glenn M. Duffield
                   (c) 1993, 1994 Geraghty & Miller, Inc.

10/24/97                                                                17:11:09

================================================================================
                              TEST DESCRIPTION

Data set........... MW37SO.DAT
Output file........ MW37SO.OUT
Data set title..... MW-37 SLUG OUT
Company............ GERAGHTY & MILLER, INC.
Project............ TF0320.015
Client............. SLOSS INDUSTRIES
Location........... BIRMINGHAM, ALABAMA
Test date.......... 8/16/97

Units of Measurement
   Length.......... ft
   Time............ min

Test Well Data
   Initial displacement in well..... 2.51
   Radius of well casing............ 0.0833
   Radius of wellbore............... 0.25
   Aquifer saturated thickness...... 26.41
   Well screen length............... 10
   Static height of water in well... 26.41
```

```
   Gravel pack porosity............. 0
   Effective well casing radius..... 0.0833
   Effective wellbore radius........ 0.25
   Log(Re/Rw)....................... 3.408
   Constants A, B and C............. 0.000 ,  0.000,  2.297
   No. of observations.............. 43

================================================================================
                              ANALYTICAL METHOD

Bouwer-Rice (Confined Aquifer Slug Test)

================================================================================
                    RESULTS FROM STATISTICAL CURVE MATCHING


STATISTICAL MATCH PARAMETER ESTIMATES

           Estimate         Std. Error
   K  =   4.2232E-003 +/-   2.2863E-005 ft/min
   y0 =   2.5246E+000 +/-   5.4013E-003 ft


ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals............... 35
   Number of estimated parameters.... 2
   Degrees of freedom................ 33
   Residual mean..................... -0.0002142
   Residual standard deviation....... 0.01607
```

Residual variance................ 0.0002583

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	2.51	2.495	0.014984	1
0.0066	2.47	2.4658	0.0042232	1
0.0099	2.44	2.4369	0.0031197	1
0.0133	2.41	2.4075	0.0025378	1
0.0166	2.45	2.3792	0.070751	1
0.02	2.36	2.3505	0.0094733	1
0.0233	2.31	2.323	-0.012981	1
0.0266	2.27	2.2958	-0.025758	1
0.03	2.25	2.268	-0.018043	1
0.0333	2.22	2.2415	-0.021464	1
0.05	2.1	2.1117	-0.011658	1
0.0666	1.97	1.9901	-0.02008	1
0.0833	1.86	1.8748	-0.014832	1
0.1	1.76	1.7663	-0.0062585	1
0.1166	1.66	1.6646	-0.0045669	1
0.1333	1.56	1.5682	-0.0081698	1
0.15	1.48	1.4774	0.0026447	1
0.1666	1.39	1.3923	-0.0022971	1
0.1833	1.31	1.3117	-0.0016675	1
0.2	1.24	1.2357	0.0042927	1
0.2166	1.17	1.1646	0.005438	1
0.2333	1.1	1.0971	0.0028792	1
0.25	1.04	1.0336	0.0064148	1
0.2666	0.98	0.97408	0.005923	1
0.2833	0.93	0.91767	0.012333	1
0.3	0.87	0.86452	0.0054762	1
0.3166	0.82	0.81475	0.0052508	1

0.3333	0.78	0.76757	0.012434	1
0.4167	0.57	0.56981	0.00018989	1
0.5	0.42	0.42316	-0.0031552	1
0.5833	0.31	0.31425	-0.0042456	1
0.6667	0.23	0.23328	-0.0032832	1
0.75	0.17	0.17324	-0.0032419	1
0.8333	0.12	0.12865	-0.0086538	1
0.9167	0.09	0.095507	-0.0055074	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

```
         Estimate
K  =   4.2232E-003 ft/min
y0 =   2.5246E+000 ft
```

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VOLUME I

APPENDIX D

SURVEY DATA

SLOSS9.ASC JUNE 1997

```
3622,1302648.851360,715224.051341,569.020000,H+T3622
3623,1302470.102840,715276.873673,541.710000,24-SL0002
3624,1302498.730380,715209.036367,544.760000,24-SL0013
3625,1302683.712280,715102.949085,551.790000,24-SL0014
3626,1302722.854300,715313.444669,549.100000,24-SL0015
3627,1302637.987300,715421.302386,538.830000,24-SL0016
3628,1302861.280820,715152.769589,563.890000,H+T3628
3629,1302365.324350,715568.680632,538.330000,24-SL0003
3630,1302383.716100,715791.693897,554.220000,H+T3630
3631,1302352.009480,715746.142387,547.050000,24-SM0001
3632,1302252.222160,715804.540621,534.370000,24-SL0004
3633,1302227.441090,715938.579913,534.020000,24-SL0005
3634,1302371.436810,716046.097728,533.820000,24-SL0006
3635,1302357.912220,715917.984712,543.740000,24-SM0002
3636,1302534.273840,716078.238104,533.010000,24-SL0007
3637,1302529.933970,715996.997423,536.320000,24-SM0003
3638,1302832.587530,715743.699270,531.880000,24-SL0012
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3642,1302739.097890,716084.202809,531.000000,24-SL0008
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3657,1301771.766950,715695.984882,537.240000,39-SM0005
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SLOSS10.ASC

JULY 1997

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July 1997

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3772,1300352.075830,714901.539449,554.340126,38-68
3773,1300308.853800,714879.528053,554.504156,38-69
3774,1300262.788910,714854.213340,553.526141,38-70
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3779,1300028.943320,714746.304892,558.358077,38-75
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AUGUST 1997

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VOLUME I

APPENDIX E

THREATENED AND/OR ENDANGERED SPECIES CORRESPONDENCE

GERAGHTY & MILLER, INC.
Environmental Services

a **heidemij** company

August 20, 1996

Ms. Jan Johnson, Science Information Manager
Natural Heritage Program
Alabama Department of Conservation
and Natural Resources
64 N. Union St., Room 421
Montgomery, AL 36130

Re: Threatened and Endangered Species Information

Dear Ms. Johnson:

The purpose of this letter is to request the most recent information concerning the occurrence of threatened and/or endangered plant and animal species, any habitats of special concern, and/or environmentally sensitive areas at or in the vicinity (within a three mile radius) of the site indicated on the enclosed figure. If such areas exist at or in the vicinity of the site, but are not in a position to be potentially impacted by the site, please indicate this in your response.

The site location can be found on the USGA Topographical Quadrangle Birmingham, North Alabama map (see attached site location map). Geraghty & Miller, Inc. is preparing an environmental study of the site and your information will be included in the report summarizing this study.

Thank you for your attention to this matter. If you have any questions, please do not hesitate to contact me at (919) 571-1662.

Sincerely,

GERAGHTY & MILLER, INC.

Rob Drake
Staff Scientist/Biologist

Enclosure

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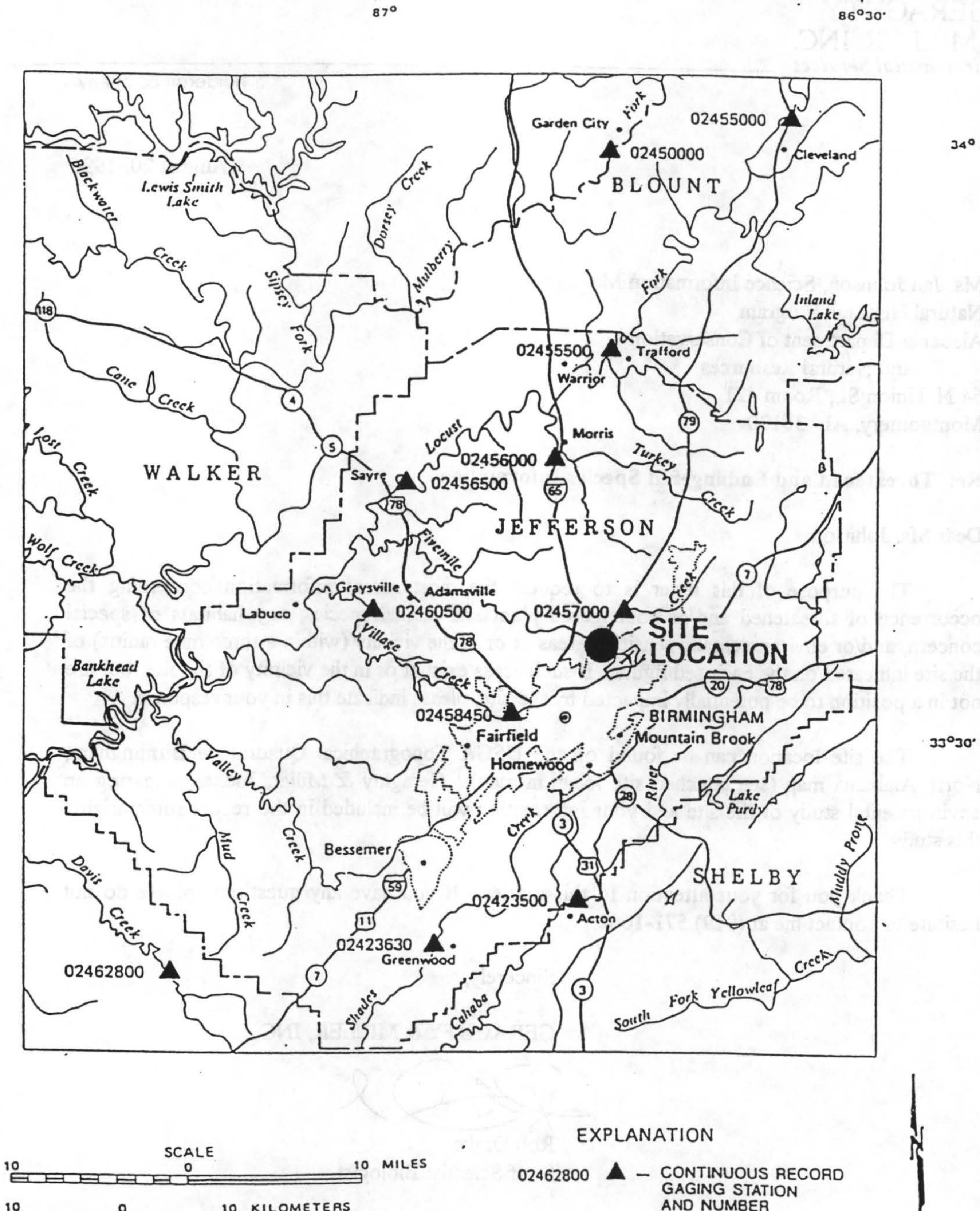


SOURCE: GEOLOGICAL SURVEY OF ALABAMA, ATLAS 16, 1980

GERAGHTY & MILLER, INC. *Environmental Services*	REGIONAL SURFACE WATER HYDROLOGY FACILITY – WIDE INVESTIGATION	FIGURE 3-2

GERAGHTY
& MILLER, INC.
Environmental Services

a **heidemij** company

August 21, 1996

Mr. Robert McCollum
Division of Game and Fish
Alabama Department of Conservation
and Natural Resources
64 N. Union St., Room 584
Montgomery, AL 36130

Re: Threatened and Endangered Species Information

Dear Mr. McCollum:

The purpose of this letter is to request the most recent information concerning the occurrence of threatened and/or endangered plant and animal species, any habitats of special concern, and/or environmentally sensitive areas at or in the vicinity (within a three mile radius) of the site indicated on the enclosed figure. If such areas exist at or in the vicinity of the site, but are not in a position to be potentially impacted by the site, please indicate this in your response.

The site location can be found on the USGA Topographical Quadrangle Birmingham, North Alabama map (see attached site location map). Geraghty & Miller, Inc. is preparing an environmental study of the site and your information will be included in the report summarizing this study. A similar request has been sent to the Alabama Natural Heritage Program.

Thank you for your attention to this matter. If you have any questions, please do not hesitate to contact me at (919) 571-1662.

Sincerely,

GERAGHTY & MILLER, INC.

Rob Drake
Staff Scientist/Biologist

Enclosure

sl g:\temp\rdrake\alt&c.doc\21-Aug-96

CrossPointe II, 2840 Plaza Place, Suite 350 • Raleigh, North Carolina 27612 • (919) 571-1662 • FAX (919) 571-7994

STATE OF ALABAMA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
64 NORTH UNION STREET
POST OFFICE BOX 301456
MONTGOMERY, ALABAMA 36130-1456

JIM FOLSOM
GOVERNOR

CHARLEY GRIMSLEY
COMMISSIONER

DIVISION OF GAME AND FISH
CHARLES D. KELLEY
DIRECTOR

26 August 1996

Rob Drake
Staff Scientist/Biologist
GERAGHTY & MILLER, INC.
Cross Pointe II
2840 Plaza Place, Suite 350
Raleigh, North Carolina 27612

Dear Mr. Drake,

This letter is to inform you that there is an endangered animal species in the vicinity of the site indicated on the figure you sent me. The Federally listed Watercress Darter (*Etheostoma nuchale*) inhabits Roebuck Springs which is located east of the site location (see figure). I cannot determine from the figure you sent me whether the site location presents potential impact to the Watercress Darter or to Roebuck Springs, nor can I determine the proximity of Roebuck Springs to the site location.

Enclosed for your information are a list of Federally designated Threatened and Endangered species known to occur in Alabama and the list of State-protected animal species.

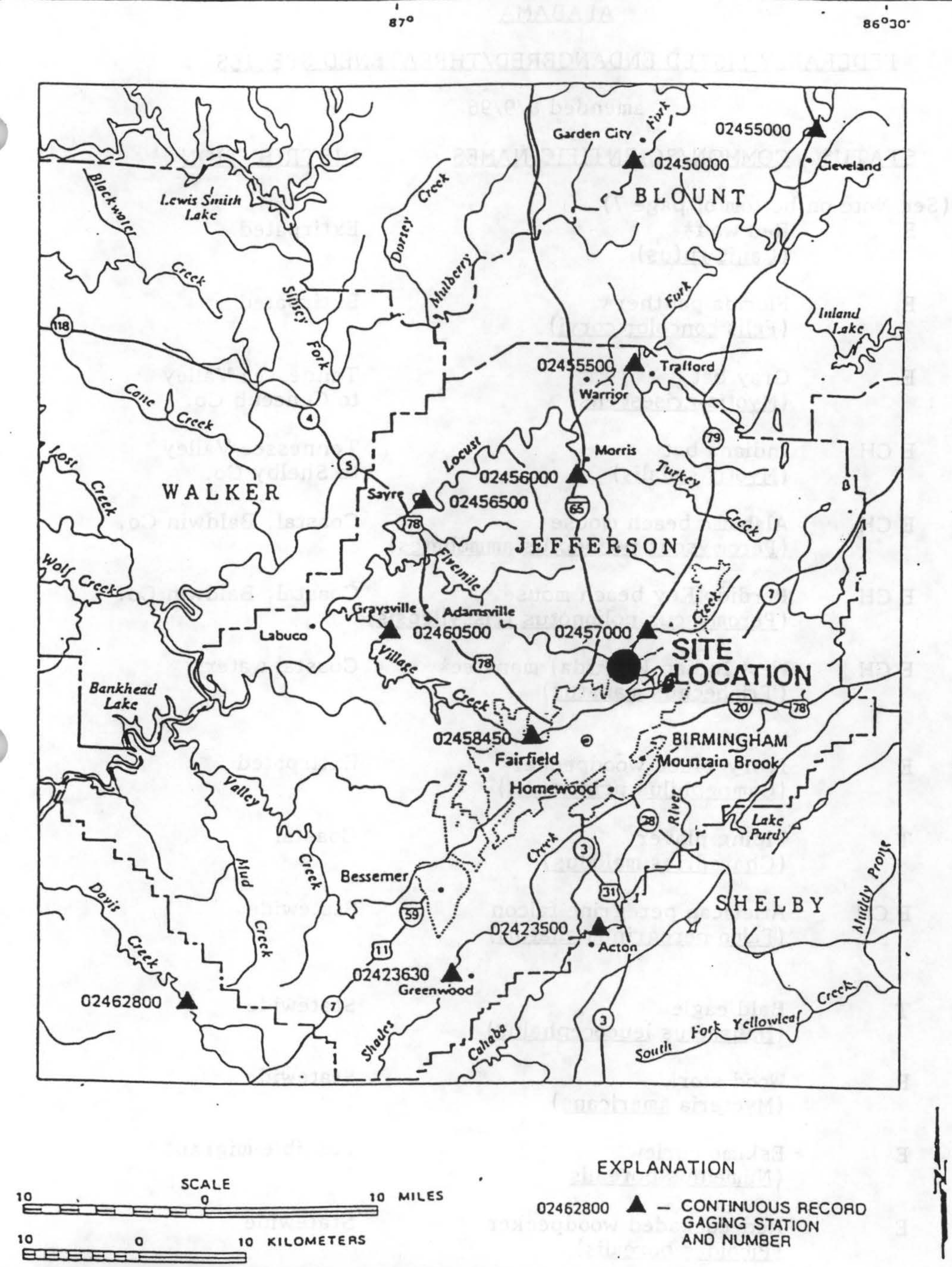
Sincerely,

Bob McCollum

Bob M^c^Collum
Nongame Biologist

Enclosures

RECEIVED
AUG 28 1996
G & M RALEIGH



SOURCE: GEOLOGICAL SURVEY OF ALABAMA, ATLAS 16, 1980

GERAGHTY & MILLER, INC.
Environmental Services

REGIONAL SURFACE WATER HYDROLOGY

FACILITY - WIDE INVESTIGATION

FIGURE 3-2

ALABAMA

FEDERALLY LISTED ENDANGERED/THREATENED SPECIES

amended 8/9/96

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
Mammals (See Note on bottom of page 7)			
(7)	E	Red wolf* (*Canis rufus*)	Extirpated
	E	Florida panther* (*Felis concolor coryi*)	Extirpated
	E	Gray bat (*Myotis grisescens*)	Tennessee Valley to Conecuh Co.
	E CH	Indiana bat (*Myotis sodalis*)	Tennessee Valley to Shelby Co.
	E CH	Alabama beach mouse (*Peromyscus polionotus ammobates*)	Coastal, Baldwin Co.
	E CH	Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*)	Coastal, Baldwin Co.
	E CH	West Indian (Florida) manatee* (*Trichechus manatus*)	Coastal waters
Birds (8)	E	Ivory-billed woodpecker* (*Campephilus principalis*)	Extirpated
	T	Piping plover (*Charadrius melodus*)	Coastal
	E CH	American peregrine falcon (*Falco peregrinus anatum*)	Statewide
	T	Bald eagle (*Haliaeetus leucocephalus*)	Statewide
	E	Wood stork (*Mycteria americana*)	Statewide
	E	Eskimo curlew (*Numenius borealis*	Possible migrant
	E	Red-cockaded woodpecker (*Picoides borealis*)	Statewide
	E	Bachman's warbler* (*Vermivora bachmanii*)	Probably Extirpated

Reptiles (9)	T	Loggerhead sea turtle (Caretta caretta)	Coastal waters
	T	Green sea turtle (Chelonia mydas)	Coastal waters
	E CH	Leatherback sea turtle (Dermochelys coriacea)	Coastal waters
	T	Eastern indigo snake (Drymarchon corais couperi)	Extreme southern counties
	E CH	Hawksbill sea turtle (Eretmochelys imbricata)	Coastal waters
	T	Gopher tortoise (Gopherus polyphemus)	Choctaw, Mobile, Washington Cos.
	E	Kemp's (Atlantic) Ridley sea turtle (Lepidochelys kempii)	Coastal waters
	E	Alabama red-bellied turtle (Pseudemys alabamensis)	Mobile, Baldwin, Monroe Cos.
	T	Flattened musk turtle (Sternotherus depressus)	Upper Black Warrior River system
Amphibians (1)	T	Red Hills salamander (Phaeognathus hubrichti)	South Central
Fish (12)	T	Gulf sturgeon (Acipenser oxyrhynchus desotoi	Coastal Delta
	T	Pygmy sculpin (Cottus pygmaeus)	Calhoun County
	T	Blue shiner (Cyprinella caerulea)	Cherokee County
	T CH	Spotfin chub (Cyprinella (=Hybopsis) monacha)	Lauderdale County Colbert County
	T CH	Slackwater darter (Etheostoma boschungi)	Madison, Lauderdale, Limestone Counties
	E	Watercress darter (Etheostoma nuchale)	Jefferson County
	E	Boulder darter (Etheostoma wapiti)	Tennessee River tributaries

	E	Cahaba shiner (Notropis cahabae)	Cahaba River
	E	Palezone shiner (Notropis spp., cf. procne)	Jackson County Paint Rock River
	T	Goldline darter (Percina aurolineata)	Cahaba River system
	T	Snail darter (Percina tanasi)	Madison County Jackson County
	E CH	Alabama cavefish (Speoplatyrhinus poulsoni)	Lauderdale County
Mollusks (37)	E	Anthony's riversnail (Anthearnia anthonyi)	Limestone Creek Limestone Co.
	E	Fanshell mussel (Cyprogenia stegaria	Tennessee River
	E	Dromedary pearly mussel (Dromus dromas)	Tennessee River
	E	Yellow-blossom pearly mussel (Epioblasma(=Dysnomia) florentina florentina)	Tennessee River
	E	Upland combshell mussel (Epioblasma metastriata)	Black Warrior, Cahaba, and Coosa River drainages
	E	Purple cat's paw pearly mussel (Epioblasma obliquata)	Tennessee River
	E	Southern acornshell mussel (Epioblasma othcaloogenesis)	Upper Coosa and Cahaba River drainages
	E	Southern combshell mussel (Epioblasma penita)	Tombigbee River, Buttahatchie River
	E	Turgid-blossom pearly mussel (Epioblasma turgidula)	Tennessee River
	E	Fine-rayed pigtoe mussel (Fusconaia cuneolus)	Paint Rock River
	E	Shiny pigtoe mussel (Fusconaia cor (=edgariana))	Paint Rock River
	E	Cracking pearly mussel (Hemistena(=Lastena) lata)	Tennessee River
	T	Fine-lined pocketbook mussel (Lampsilis altilis)	Statewide

E	Pink mucket pearly mussel (Lampsilis abrupta (=orbiculata))	Tennessee River, Paint Rock River
T	Orange-nacre mucket (Lampsilis perovalis)	Tombigbee, Black-Warrior, Alabama, Cahaba drainages
E	Alabama lamp pearly mussel (Lampsilis virescens)	Paint Rock River, Hurricane Creek
T	Alabama moccasinshell mussel (Medionidus acutissimus)	Alabama, Tombigbee, Cahaba, Coosa, Black Warrior drainages
E	Coosa moccasinshell mussel (Medionidus parvulus)	Coosa, Cahaba, and Black Warrior drainages
E	Ring pink mussel (Obovaria retusa)	Tennessee River
E	Little-wing pearly mussel (Pegias fabula)	Tennessee River
E	White wartyback pearly mussel (Plethobasus cicatricosus)	Tennessee River
E	Orange-footed pearly mussel (Plethobasus cooperianus)	Tennessee River
E	Clubshell (Pleurobema clava)	Tennessee River drainage
E	Black clubshell mussel (Pleurobema curtum)	Tombigbee River
E	Southern clubshell mussel (Pleurobema decisum)	Statewide except Mobile Delta
E	Dark pigtoe mussel (Pleurobema furvum)	Black Warrior River drainage
E	Southern pigtoe mussel (Pleurobema georgianum)	Coosa River drainage
E	Flat pigtoe mussel (Pleurobema marshalli)	Tombigbee River
E	Ovate clubshell mussel (Pleurobema perovatum)	Statewide
E	Rough pigtoe mussel (Pleurobema plenum)	Tennessee River
E	Heavy pigtoe mussel (Pleurobema taitianum)	Tennessee River

	T	Inflated heelsplitter mussel (Potamilus inflatus)	Black Warrior River to Mobile Bay
	E	Triangular kidneyshell mussel (Ptychobranchus greeni)	Black Warrior, Cahaba, and Coosa River drainages
	E	Cumberland monkeyface pearly mussel (Quadrula intermedia)	Tennessee River
	E	Stirrup shell mussel (Quadrula stapes)	Tombigbee River, Sipsey River
	E	Pale lilliput pearly mussel (Toxolasma (=Caruncuilina) cylindrellus)	Paint Rock River, Hurricane Creek
	E	Tulotoma snail (Tulotoma magnifica)	Coosa River System, Choccolocco Creek
Arthropods			
Crustacea (1)	E	Alabama cave shrimp (Palaemonias alabamae)	Madison County
Insecta (1)	E	American burying beetle (Nicrophorus americanus)	Statewide
Plants (18)	T	Little amphianthus (Amphianthus pusillus)	Chambers, Randolph Counties
	T	Price's potato-bean (Apios priceana)	Marshall, Autauga Cos.
	E	Rock cress (Arabis perstellata)	Bibb County
	E	Morefield's leather flower (Clematis morefieldii)	Madison Co.
	E	Alabama leather flower (Clematis socialis)	St. Clair, Cherokee Counties
	E	Leafy prairie-clover (Dalea foliosa)	Franklin, Morgan, Lawrence, Jefferson Cos.
	E	Gentian pinkroot Spigelia gentianoides	Bibb County
	T	Lyrate bladder-pod (Lesquerella lyrata)	Colbert, Franklin Cos.

E	Pondberry (Lindera melissifolia)	Wilcox County
T	Mohr's Barbara's buttons (Marshallia mohrii)	Bibb, Cullman, Cherokee, Walker, Etowah Cos.
T	American hart's-tongue fern (Asplenium scolopendrium var. americanum) (=Phyllitis japonica ssp. americanum)	Morgan, Jackson Cos.
E	Harperella (Ptilimnium nodosum	Cherokee, DeKalb Cos.
T	Kral's water-plantain (Sagittaria secundifolia)	Cherokee, DeKalb Cos.
E	Green pitcher plant (Sarracenia oreophila)	Marshall, Jackson, Etowah, DeKalb, Cherokee, Elmore, Russell Cos.
E	Alabama canebrake pitcher-plant (Sarracenia rubra alabamensis) (=S. alabamensis ssp. alabamensis)	Autuga, Chilton, Elmore Cos.
E	American chaffseed (Schwalbea americana)	
T	Alabama streak-sorus fern (Thelypteris pilosa var. alabamensis)	Winston County
E	Relict trillium (Trillium reliquum)	Henry, Lee, Bullock Cos.
E	Tennessee yellow-eyed grass (Xyris tennesseensis)	Franklin Co.

Total Animal Species: 76 (not including 5 species of whales)
Total Plant Species: 18

* = Not believed to occur in Alabama

Status:
E = endangered
T = threatened
CH = critical habitat has been designated

The American alligator is neither threatened nor endangered, but designated so because of similarity of appearance to the threatened American crocodile.

NOTE: There are 5 endangered species of whales found in coastal waters of the southeastern states. These include the finback whale (Balaenoptera physalus), the humpback whale (Megaptera novaeangliae), the right whale (Balaena glacialis), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter catodon). It is possible, though unlikely, that they could appear in Alabama coastal waters.

ALABAMA

220-2-.92 Non-game Species Regulation

(1) It shall be unlawful to take, capture, kill, or attempt to take, capture or kill; possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, the following non-game wildlife species (or any parts or reproductive products of such species) without a scientific collection permit or written permit from the Commissioner, Department of Conservation and Natural Resources, which shall specifically state what the permittee may do with regard to said species:

(a) FISHES

Common Name	*Scientific Name*
• Cavefish, Alabama	Speoplatyrhinus poulsoni
• Cavefish, Southern	Typhlichthys subterraneus
• Chub, Spotfin	Cyprinella monacha
• Darter, Boulder	Etheostoma wapiti
• Darter, Coldwater	Etheostoma ditrema
• Darter, Crystal	Crystallaria asprella
• Darter, Goldline	Percina aurolineata
• Darter, Slackwater	Etheostoma boschungi
• Darter, Snail	Percina tanasi
• Darter, Tuscumbia	Etheostoma tuscumbia
• Darter, Watercress	Etheostoma nuchale
• Madtom, Frecklebelly	Noturus munitus
• Sculpin, Pygmy	Cottus pygmaeus
• Shiner, Blue	Cyprinella caerulea
• Shiner, Cahaba	Notropis cahabae
• Shiner, Palezone	Notropis albinotus

(b) AMPHIBIANS

Common Name	*Scientific Name*
• Frog, Dusky Gopher	Rana capito sevosa
• Hellbender, Eastern	Cryptobranchus alleganiensis alleganiensis
• Salamander, Flatwoods	Ambystoma cingulatum
• Salamander, Green	Aneides aeneus
• Salamander, Red Hills	Phaeognathus hubrichti
• Salamander, Seal	Desmognathus monticola (of Coastal Plain origin)
• Salamander, Tennessee Cave	Gyrinophilus palleucus
• Treefrog, Pine Barrens	Hyla andersonii

(c) REPTILES

Common Name	*Scientific Name*
• Coachwhip, Eastern	Masticophis flagellum flagellum
• Snake, Black Pine	Pituophis melanoleucus lodingi
• Snake, Eastern Indigo	Drymarchon corais couperi
• Snake, Florida Pine	Pituophis melanoleucus mugitus
• Snake, Gulf Salt Marsh	Nerodia fasciata clarki
• Snake, Southern Hognose	Heterodon simus
• Terrapin, Mississippi Diamondback	Malaclemys terrapin pileata
• Tortoise, Gopher	Gopherus polyphemus
• Turtle, Alabama Map	Graptemys pulchra
• Turtle, Alabama Red-bellied	Pseudemys alabamensis
• Turtle, Alligator Snapping	Macroclemys temmincki
• Turtle, Barbour's Map	Graptemys barbouri

(d) BIRDS

Common Name	*Scientific Name*
• Crane, Mississippi Sandhill	Grus canadensis pulla
• Dove, Common Ground	Columbina passerina
• Eagle, Bald	Haliaeetus leucocephalus
• Eagle, Golden	Aguila chrysaetos
• Egret, Reddish	Egretta rufescens
• Falcon, Peregrine	Falco peregrinus
• Hawk, Cooper's	Accipiter cooperi
• Merlin	Falco columbarius
• Osprey	Pandion haliaetus
• Oystercatcher, American	Haematopus palliatus
• Pelican, American White	Pelecanus erythrorhynchos
• Plover, Piping	Charadrius melodus
• Plover, Snowy	Charadrius alexandrinus
• Plover, Wilson's	Charadrius wilsonia
• Stork, Wood	Mycteria americana
• Tern, Gull-billed	Sterna nilotica
• Warbler, Bachman's	Vermivora bachmani
• Woodpecker, Red-cockaded	Picoides borealis
• Wren, Bewick's	Thryomanes bewickii

(e) MAMMALS

• *Common Name*	*Scientific Name*
• Bat, Gray Myotis	Myotis grisescens
• Bat, Indiana	Myotis sodalis
• Bat, Rafinesque's Big-eared	Plecotus rafinesquii
• Bat, Southeastern	Myotis austroriparius
• Gopher, Southeastern Pocket	Geomys pinetis
• Mouse, Alabama Beach	Peromyscus polionotus ammobates
• Mouse, Meadow Jumping	Zapus hudsonius
• Mouse, Perdido Key Beach	Peromyscus polionotus trissylepsis
• Weasel, Long-tailed	Mustela frenata

(f) Other State or Federally protected non-game species.

In addition any required federal permits for federally protected species must be obtained.

(2) It shall be unlawful to collect or offer for sale, sell, or trade for anything of value any box turtle (Terrapene carolina), box turtle part or reproductive product except by permit as outlined in paragraph (1).

(3) It shall be unlawful to collect, harvest, possess, offer for sale, sell or trade for anything of monetary value any common snapping turtle (Chelydra serpentina serpentina) or soft shell turtles (Apalone ferox, Apalone muticus muticus, Apalone muticus calvatus, Apalone spiniferus spiniferus, Apalone spiniferus asper) with a carapace length less than eight inches. (Except any species protected under this paragraph taken in a live trap by a pond owner or his agent while controlling nuisance animals is exempt but may not be sold or offered for sale or traded for anything of monetary value.)

(4) Informational Note: See Section 9-11-269, Code of Alabama 1975, relating to protection of the flattened musk turtle (Sternotherus minor depressus).

I, ~~L O Dustin~~ __________, am responsible for filing documents in the

(Name of file) Sloss Ind Inc file. The attached document,

(Name of document) RCRA Facil. Inv. Land Disp. Areas Vol I of III

was originally submitted to the Alabama Department of Environmental

Management in a 3-ring binder.

For ease of filing, only the binder has changed. No material has changed in the

document. No other alterations have been made to said document, and it is

otherwise in its original form as submitted to the Alabama Department of

Environmental Management.

L O Dustin
____

Done this 27th of Dec, 2000

Witness: [signature]

RCRA Facility Investigation Land Disposal Areas Volume II of III

Investigation Derived Waste Report (January 1998 - Revised November 2000)

ARCADIS GERAGHTY & MILLER

27 November 2000

PREPARED FOR

Sloss Industries, Inc.
Birmingham, Alabama

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GLOSSARY OF ABBREVIATIONS

BTF	Biological Treatment Facility
CFR	Code of Federal Regulations
DOT	Department of Transportation
IDW	Investigation Derived Waste
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
PAH	Polycyclic Aromatic Hydrocarbon
PP	Priority Pollutant
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
RBC	Risk-Based Concentration
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Treatment, Storage, or Disposal
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

Sloss Industries Corporation (Sloss) in Birmingham, Alabama conducted the Land Disposal Areas portion of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in June through August 1997. Investigation derived waste (IDW) was generated during the course of the investigation from the installation of 6 new monitor wells and 10 soil borings and groundwater sampling of 20 monitor wells (Figures 1-1 and 1-2). The IDW resulted from 1) soil and rock cuttings generated during the installation of the six new monitor wells and soil cuttings generated during installation of 10 soil borings located adjacent to existing monitor wells, 2) purge water generated during development water from the six new monitor wells and groundwater sampling of 20 monitor wells, 3) liquids and cuttings (from decontamination of drilling equipment) generated from decontamination of personnel and equipment at the decontamination pad, and 4) decontamination pad materials.

A decontamination pad for decontamination of drilling equipment was constructed on a bermed, concrete pad at the Sloss facility, near the Chemical Manufacturing Plant, using visquene. As a result of the hot, dry Birmingham summer, water used during decontamination had for the most part evaporated during the course of the Land Disposal Areas investigation.

During the Land Disposal Areas investigation, all IDW materials were stored in Department of Transportation (DOT) approved 55-gallon drums and initially staged adjacent to the monitor well or boring generating the material. The drums were properly labeled indicating the location from which the material was generated, the type of material stored, and the date generated. At the conclusion of the field program, the IDW drums were placed on pallets and centralized to a bermed, concrete pad near the Chemical Manufacturing Plant where the decontamination pad was constructed.

The U.S. Environmental Protection Agency (USEPA) Region IV guidance document, "Management of Contaminated Media," Guidance Number TSC-92-02, dated December 28, 1992, was used as a guideline for characterization and handling of the IDW materials (Appendix A). This RFI Land Disposal Areas IDW Report discusses the characterization rationale, sampling and analytical results, characterization of IDW, and recommended management practices for the IDW material.

2.0 IDW CHARACTERIZATION RATIONALE

The USEPA guidance document TSC-92-02 regarding management of contaminated media (groundwater, surface water, soils, and sediments) was used to develop the rationale for management of the IDW generated during the Land Disposal Areas investigation at Sloss Industries.

2.1 USEPA POLICY

All currently available USEPA policy pertains to environmental media known to be contaminated with a listed hazardous waste. These documents collectively make up the "contained-in" policy. However, the "contained-in" policy does not address contamination from characteristic hazardous waste. Furthermore, many times there is no clear documentation that an environmental media was contaminated by either a listed or characteristic hazardous waste (as is often the case at solid waste management units). Consequently, USEPA has clarified this area as it pertains to "contaminated media" (USEPA Guidance Number TSC-92-02).

Human health and environmental risk are the basis for controlled management of IDW per USEPA Region IV guidance. By definition, a medium is "contaminated" if one or more hazardous constituents, as identified in 40 Code of Federal Regulations (CFR) Part 261 Appendix VIII, are present above levels of human health or environmental concern and above naturally occurring (background) levels (this is specifically for areas where there are naturally occurring high levels of Appendix VIII constituents). According to USEPA, contaminated environmental media should either be managed in accordance with RCRA Subtitle C requirements or "best management practices." However, if a contaminated medium is treated to concentrations at or below risk-based standards (or to naturally occurring background levels), it can be rendered "decontaminated."

2.1.1 USEPA Contaminated Media Management

Once an environmental medium is determined to be "contaminated," knowledge of how the medium became contaminated dictates how that medium must be managed. The decision matrix in Figure 2-1 was provided by USEPA to assist the user in making the correct regulatory decision for management of contaminated media. A contaminated media must ultimately be managed in one of two ways, 1) as if it were a hazardous waste, or 2) in accordance with "best management practices."

The USEPA Region IV Decision Matrix for Managing Contaminated Media, as shown in Figure 2-1, is summarized below:

1) Determine if the medium is a listed waste or contaminated by a listed waste. Both contaminated media which are themselves listed hazardous wastes (P- and U-listed wastes) and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Once a medium is decontaminated such that it no longer is a listed hazardous waste (P- and U-listed wastes) or no longer "contains" the listed hazardous waste, the Subtitle C ceases to apply.

2) Determine if the medium is contaminated by a characteristic waste. Another way in which media may become "contaminated" is through contact with a characteristic hazardous waste. If it can be validated that the medium was not contaminated by a characteristic hazardous waste, then the medium may be managed in accordance with best management practices.

3) Test for hazardous waste characteristics and determine if medium exhibits a hazardous waste characteristic. If knowledge of the originating waste stream indicates that contamination did result from a characteristic hazardous waste, or if

the source of contamination is unknown, then the medium must be tested to determine whether it exhibits a hazardous waste characteristic.

4) Compare results to risk-based levels to determine if the soil is contaminated. If contaminated, best management practices should be applied.

In summary, contaminated media which are themselves hazardous wastes (P- and U-listed wastes); media which exhibit a hazardous waste characteristic; and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is a listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices should be applied.

The USEPA policy indicates that decontamination is required for all Appendix VIII constituents which are above health-based limits and background, not merely the Appendix VIII constituent for which the waste was listed or which caused the medium to exhibit a hazardous characteristic.

2.1.2 USEPA Site Investigation Residues

Residues (purge water, drill cuttings, drilling fluids, etc.) from investigative efforts should be containerized from areas of suspected contamination or from areas where documentation does not exist to confirm that the contamination source was a listed hazardous waste until test results are available to determine whether the residue exhibits a hazardous waste characteristic (USEPA Guidance Number TSC-92-02). If the residue does not exhibit a hazardous waste characteristic, then Subtitle C regulations do not apply but the environmental sampling residues should still be managed in a manner that is protective of human health and the environment (i.e. best management practices).

Best management practices should be followed any time test results indicate residues contain hazardous constituents (Appendix VIII) above a health or environmental based limit (but the residues do not exhibit a hazardous characteristic and the contamination is not a listed waste). Best management practices suggest that contaminated sampling residues be treated or disposed in a unit that is operated in accordance with an environmental permit. If treatment or disposal in a permitted unit at the facility is not an available option, then the residues may be sent to an approved off-site facility for treatment or disposal. Alternatively, the residues may be stored at a secure location at the facility until the site under investigation is remediated. The residues should then be included in the remediation process.

2.2 SLOSS IDW CHARACTERIZATION RATIONALE

The IDW characterization rationale developed for the Land Disposal Area investigation follows the USEPA decision matrix provided in USEPA Guidance Number TSC-92-02. The following text describes how the matrix steps have been applied to the Sloss Land Disposal Areas IDW. Sloss Industries does not have a RCRA permit and therefore does not have any RCRA units. Sloss is not a Treatment, Storage, or Disposal (TSD) facility.

1) Determine if the medium is a listed waste or contaminated by a listed waste: Sloss Industries Corporation produces eight listed wastes: six coking wastes (K087, K141, K142, K143, K144 and K145) generated at the Coke Manufacturing Plant and F003 and F005 wastes generated at the Chemical Manufacturing Plant. The coking wastes are exempt as specified in Alabama Department of Environmental Management Administrative Code Rule 335-14-2-.01(4)(a)(10) because these wastes are recycled to the coke ovens. The F003 and F005 wastes are disposed at a permitted hazardous waste disposal facility as necessary. During the Land Disposal Areas investigation, monitor wells and soil borings were not installed in the vicinity of the Coke Manufacturing Plant and Chemical Manufacturing Plant where these wastes are produced.

2) Determine if the medium is contaminated by a characteristic waste. According to plant personnel, the environmental medium has not been contaminated by a characteristic waste. Analytical testing performed as part of Item (3) is used to validate this information.

3) Test for hazardous waste characteristics and determine if medium exhibits a hazardous waste characteristic. Soil and groundwater data collected during the Land Disposal Areas investigation was used to determine whether soil cuttings and purge water exhibit a hazardous waste characteristic. Additionally, soil and/or rock cuttings from the six new monitor wells and the decontamination pad and soil cuttings from one soil boring were tested to determine whether they exhibit a hazardous waste characteristic. Total results obtained from the laboratory analyses of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), the thirteen Priority Pollutant (PP) metals, barium, and cyanide were compared with the toxicity characteristics (TC) levels for hazardous waste. Although toxicity characteristic leaching procedure (TCLP) analyses were not performed on drill cuttings, the soil sampling total concentration results were divided by 20, the dilution factor for the TCLP extraction, to determine if the TCLP standards could be exceeded. In the event that a metal or compound appeared to exceed the TCLP level, the drum will be sampled and TCLP analysis will be performed for the analyte in question to confirm the results.

4) Compare results to risk-based levels to determine if the soil is contaminated. Sloss Industries Corporation proposes using USEPA Risk-Based Concentrations (RBCs) (October 22, 1997) for soil and tap water or Maximum Contaminant Levels (MCLs) as the risk-based levels used to determine if the soil and rock cuttings and purge water containerized at Sloss are contaminated (Appendix B). The RBCs for industrial soil ingestion will be used to evaluate the soil and rock

cutting data and the EPA MCLs (or RBCs for tap water) will be used to evaluate the purge water data (Table 2-1).

RBCs are chemical concentrations corresponding to fixed levels of risk (i.e., hazard quotient of 1, or a lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) (Appendix B). The RBCs were developed by taking toxicity constants (reference doses and carcinogenic potency slopes) and combining these constants with "standard" exposure scenarios. (Appendix B). Rather than developing site specific risk-based levels, Sloss will use the conservative assumptions inherent to RBCs provided by the USEPA to evaluate proper management practices for the Land Disposal Areas IDW. The use of the RBCs appears to satisfy the USEPA Guidance TSC-92-02 criteria for determining risk-based levels for management of contaminated media. The RBCs will be used to evaluate whether the IDW will be managed on site (best management practices) or disposed of offsite (as a contaminated media).

Background soil data collected during the Facility-Wide investigation is also used to determine whether the soil is contaminated (Table 2-1). For example, the naturally occurring concentrations of arsenic and beryllium in the soil exceed the calculated RBCs. In these cases, the cuttings are considered contaminated if concentrations exceed background levels.

3.0 CHARACTERIZATION OF IDW

The procedures utilized to sample and characterize the IDW soil cuttings are discussed in the following sections.

3.1 SAMPLING PROCEDURES

3.1.1 Soil and/or Rock Cuttings

IDW soil cuttings, which includes unconsolidated material such as clay and other fill materials, were containerized at SWMUs 23, 38, and 39 from six new monitor well boreholes and 10 soil borings located adjacent to existing monitor wells during the subsurface soil sampling investigation. Additionally, rock and soil cuttings generated during installation of the six new monitor wells were containerized. The rock and soil cuttings generated during monitor well installation and soil cuttings generated during the subsurface soil sampling were containerized in separate drums so the subsurface soil sampling data could be used to characterize the IDW soil cuttings. Samples of the drummed rock and soil cuttings were collected and analyzed to characterize the rock material.

The subsurface soil sampling data collected during the Land Disposal Areas investigation were used to characterize the IDW soil cuttings from four of the six new monitor wells (MW-21, MW-29, MW-33, and MW-37) and from 9 soil borings installed adjacent to existing monitor wells MW-23, MW-24, MW-25S/MW-25D, MW-26, MW-27, MW-28, MW-30D/MW-30S, MW-34S/MW-34D and MW-36 (Tables 3-1 and 3-2). Selected soil samples were analyzed from each monitor well borehole or soil boring for total VOCs (USEPA Method 8260), SVOCs (USEPA Method 8270), the thirteen PP metals, barium and cyanide. Soil samples were collected according to procedures discussed in Section 3.0 of the RFI Land Disposal Areas Report. Appendix A of Volume I of the RFI Land Disposal Areas contains soil sampling logs for the soil samples and

Volume III contains the analytical data and data validation check lists for the soil sampling. Soil sampling data are summarized in Tables 3-1 and 3-2.

Subsurface soil data was not available from the soil boring installed adjacent to MW-32 and from the MW-31 borehole because only fill material (flue dust) was found at these locations and soil samples were not collected for laboratory analysis; therefore, the drummed soil cuttings were sampled to characterize the IDW. Soil cuttings from the subsurface soil sampling and rock cuttings generated during monitor well installation of MW-35 were mixed together; therefore, the drummed soil cuttings were sampled to characterize the IDW.

IDW rock cuttings containerized at new monitor MW-37, IDW rock and soil cuttings containerized at new monitor wells MW-21, MW-29, MW-31, MW-33, and MW-35, and soil cuttings from the soil boring installed adjacent to MW-32 (39-SBMW32) were sampled to characterize the IDW (Table 3-3). Additionally, three drums of soil cutting and decontamination pad material containerized from the decontamination pad were sampled. Several drums of rock and/or soil cuttings were containerized for each well. To prevent volatilization during sampling of the IDW rock and/or soil cuttings, material from each drum was collected for VOC analysis by transferring the soil directly from the drum to the appropriate sample container using a stainless steel spoon. For each monitor well, the VOC samples from the individual drums were composited by the laboratory before VOC analysis.

For non-volatile analysis, soil cuttings were collected from each drum using a stainless steel spoon and placed in a stainless steel bowl, then thoroughly mixed using the stainless steel spoon. The material was scraped from the sides and rolled to the middle of the bowl and initially mixed. The sample was then quartered and moved to the edges of the bowl. Each quarter was then mixed individually. The quarters were then recombined into the center of the bowl and the entire sample was mixed one final time.

The sample was then spooned into wide-mouth glass jars with Teflon™ lined caps. The samples were immediately placed in a cooler with ice and transported to the laboratory.

The IDW rock and/or soil cuttings from the new monitor wells, soil boring, and the decontamination pad were sampled and analyzed for total VOCs (USEPA Method 8260A), SVOCs (USEPA Method 8270B), the thirteen PP metals, barium and cyanide. Appendix C of this IDW report contains the soil sampling logs for the IDW rock and/or soil cutting IDW sampling. Analytical results and the data validation check list are included in Volume III of the RFI Land Disposal Areas Report. Soil sampling data is summarized in Table 3-3.

3.1.2 Development and Purge Water

Development of the six newly installed wells and groundwater sampling of 20 new and existing monitor wells at SWMUs 23, 38, and 39 generated purge water which was containerized in drums. The groundwater sampling data collected during Land Disposal Areas investigation were used to characterize the IDW purge water. Groundwater samples were analyzed for total VOCs (USEPA Method 8260), SVOCs (USEPA Method 8270), the thirteen PP metals, barium and cyanide. The groundwater samples were collected according to procedures discussed in Section 3.0 of the RFI Land Disposal Areas Report. Appendix A of Volume I of the RFI Land Disposal Areas Report contains water sampling logs for the groundwater samples and Volume III contains the analytical data and data validation check lists for the groundwater samples. Groundwater data are summarized in Tables 3-4 and 3-5.

3.1.3 Decontamination Pad Materials

Results from the IDW soil cuttings will be used to characterize the drummed visquene from the decontamination pad (Table 3-3). These analytical results will characterize any soil cutting residue remaining on the visquene.

3.2 CHARACTERIZATION OF SOIL AND/OR ROCK CUTTING IDW

Subsurface soil samples collected during the Land Disposal Areas investigation and the IDW rock and/or soil cutting samples from the new monitor wells, one soil boring, and the decontamination pad were analyzed for VOCs, SVOCs, PP metals, barium and cyanide. Three VOCs, 14 SVOCs, 13 of which were polycyclic aromatic hydrocarbons (PAHs), 12 metals and cyanide were detected in the IDW soil. These soil sampling results are summarized in Tables 3-1 through 3-3 and in Section 4.0 of Volume I of the RFI Land Disposal Areas Report.

3.2.1 Hazardous Waste Characteristics

Based on a review of the available analytical data, IDW soil and/or rock cuttings from monitor wells MW-32 and MW-33 containerized during the Land Disposal Areas investigation may exhibit characteristics of hazardous waste because total results for cadmium, chromium, and lead detected in MW-32 soil cuttings and cadmium and lead detected in MW-33 soil and rock cuttings may exceed RCRA TC Levels (Table 3-3). IDW soil and/or rock cuttings from these monitor wells will be sampled and TCLP analysis for cadmium, lead, and chromium will be performed to determine whether the cuttings are hazardous.

3.2.2 Contaminated Soil and/or Rock Cutting IDW

Based on a review of the available analytical data, IDW rock and/or soil cuttings from one new monitor well and two monitor well soil borings contained concentrations which exceeded USEPA Industrial RBCs for soil ingestion (Tables 3-1 to 3-3, and 3-6).

VOC compounds detected did not exceed USEPA Industrial RBCs for soil ingestion. One PAH, benzo(a)pyrene, exceeded the USEPA Industrial RBC for soil ingestion in rock and soil cuttings containerized from MW-35 (Table 3-3).

The USEPA Industrial RBCs for arsenic and beryllium were exceeded in a number of the soil borings (Tables 3-1 through 3-3). In order to evaluate this data, it was necessary to evaluate background concentrations of these constituents. This conclusion was reached based upon USEPA Guidance Number TSC-92-02 which indicates background concentrations can be used to determine if a waste is contaminated.

Site background concentrations of arsenic detected range from 1.9 to 21 milligrams per kilogram (mg/kg) and site background concentrations of beryllium detected range from 0.51 to 2.6 mg/kg. The concentrations of arsenic and beryllium detected in the IDW soil cuttings are within the site background concentration ranges for these compounds based on background soil data collected at the site except for the arsenic concentration in soil sample 970805-LD-23-SL0024(14-16) collected from the monitor well MW-24 soil boring and the beryllium concentration detected in 970807-LD-38-SL0029(19-21) collected from monitor well MW-29 borehole which exceeded the site background concentration range (Tables 3-1 through 3-3).

Based on these results, the IDW soil cuttings from the soil boring installed adjacent to monitor well MW-24 and from the MW-29 borehole and rock and soil cuttings from MW-35 are considered contaminated because of benzo(a)pyrene or metals (beryllium or arsenic) concentrations (Tables 3-6 and 3-7). The IDW soil cuttings from the decontamination pad did not contain concentrations which exceeded USEPA RBCs.

3.3 CHARACTERIZATION OF PURGE WATER IDW

Groundwater samples collected during the Land Disposal Areas were analyzed for VOCs, SVOCs, PP metals, barium and cyanide. Five VOCs, seven metals and cyanide were detected in the IDW purge water. These groundwater sampling results are summarized in Tables 3-4 and 3-5 and in Section 4.0 of Volume I of the RFI Land Disposal Areas Report

3.3.1 Hazardous Waste Characteristics

Based on a review of the available analytical data, none of the IDW purge water containerized during the Land Disposal Areas investigation exhibit characteristics of hazardous waste (Tables 3-4 and 3-5)

3.3.2 Contaminated Purge Water IDW

Based on a review of the available analytical data, IDW purge water from five of the monitor wells contained concentrations which exceeded USEPA MCLs (Tables 3-8).

Benzene detected in MW-26 and MW-34D exceeded the USEPA MCL. SVOCs were not detected in the groundwater samples (Tables 3-4 and 3-5).

Two metals and cyanide exceeded USEPA MCLs. The USEPA MCL for lead was exceeded in MW-34D, the MCL for silver was exceeded in MW-36 and the MCL for cyanide was exceeded in MW-32 and MW-34S (Tables 3-4 and 3-5).

Based on these results, the IDW purge water from five of the monitor wells MW-26, MW-32, MW-34S, MW-34D, and MW-36 are considered contaminated because of benzene, metals (lead and silver), or cyanide concentrations (Table 3-8).

3.4 DECONTAMINATION PAD MATERIALS

3.4.1 Hazardous Waste Characteristics

Since none of the IDW soil cuttings from the decontamination pad exhibited characteristics of hazardous waste (Section 3.2.1), it follows that the decontamination pad materials do not exhibit characteristics of hazardous waste (Table 3-3).

3.4.2 Contaminated Materials

Based on a review of the analytical data for the IDW soil cuttings collected from the decontamination pad, it follows that the decontamination pad materials are not contaminated (Tables 3-3 and 3-6).

4.0 PROPOSED WASTE MANAGEMENT PRACTICES

4.1 SOIL AND/OR ROCK CUTTING IDW

Characterization of IDW soil cuttings indicated that IDW soil cuttings, which consist of SWMU 39 flue dust (sludge) or flue dust and limestone, from monitor wells MW-32 and MW-33 may have characteristics of hazardous waste (Tables 3-6 and 3-7). The IDW soil cuttings will be sampled and TCLP analysis performed for the analytes in question. If TCLP results indicate the IDW soil cuttings are hazardous, the proposed management practice for handling and disposal is to handle the drums as hazardous waste and dispose of the material accordingly (Table 3-6). If TCLP results indicate that the IDW soil is not hazardous, the soil will be disposed of as contaminated media. The TCLP results and recommendations for disposal will be provided under separate cover.

IDW soil cuttings containerized from the monitor well MW-24 soil boring (one drum) and the monitor well MW-29 borehole (one drum) and rock and soil cuttings containerized at MW-35 (two drums) contained concentrations of SVOCs (benzo(a)pyrene) which exceeded USEPA Industrial RBCs and/or contained beryllium and arsenic concentrations above site background (Tables 3-6 and 3-7). Because the soil and/or rock cuttings from these soil borings contained concentrations of compounds which exceeded the RBCs or background concentrations, the soil cuttings have been characterized as contaminated media.

The proposed best management practice for handling and disposal of the IDW soil characterized as contaminated from monitor wells MW-24 and MW-29 and soil and rock cuttings from MW-35 is to handle the four drums containing cuttings as if they were a hazardous waste and dispose of the material accordingly (Tables 3-6 and 3-7). Although this material is non-hazardous, solid waste landfills may hesitate to accept the IDW soil cuttings because they are contaminated.

The IDW soil cuttings from the remaining monitor well boreholes and monitor well soil borings and rock and/or soil cuttings from the monitor wells and decontamination pad do not contain concentrations of compounds which exceed USEPA industrial RBCs (Tables 3-6 and 3-7). The proposed best management practice for handling the IDW soil cuttings is to place the material at the on site land disposal area, SWMU 38, Landfill. After removing the IDW soil cuttings, the drums will be triple rinsed, crushed, and placed in the metal scrap pile for recycling at the U.S. Pipe North Birmingham facility. Rinse waters will be collected/directed to the Biological Tréatment Facility (BTF).

4.2 DEVELOPMENT AND PURGE WATER IDW

Characterization of IDW purge water indicated that none of the IDW water has characteristics of hazardous waste (Table 3-8).

IDW purge water containerized from monitor wells contained concentrations of one VOC (benzene), two metals (lead and silver), and cyanide which exceeded USEPA MCLs (Tables 3-4 and 3-5). Because the purge water from these monitor wells contained concentrations of compounds which exceeded USEPA MCLs, the purge water has been characterized as contaminated media. The proposed best management practice for handling and disposal of the IDW purge water for monitor wells MW-26, MW-32, MW-34D, MW-34S, and MW-36 is to dispose of the water in the BTF with site process water (Table 3-8). This facility is capable of processing the water and will not result in any exceedences of the Facility's NPDES permit.

The IDW purge water from the remaining 15 monitor wells do not contain concentrations of compounds which exceed USEPA MCLs (Table 3-8). The proposed best management practice for these monitor wells is to dispose of the water in the BTF at the Sloss Facility.

After disposing of the IDW purge water, the drums will be triple rinsed, crushed, and placed in the metal scrap pile for recycling at the U.S. Pipe North Birmingham facility. Rinse waters will also be collected/directed to the BTF.

4.3 DECONTAMINATION PAD MATERIALS

Decontamination pad materials can be disposed of as a solid waste since the materials are non-hazardous and not contaminated. The decontamination pad materials will be placed in a dumpster at the Sloss Facility and disposed of by the site trash collector.

5.0 REFERENCES

U. S. Environmental Protection Agency, 1997. Risk-Based Concentration Table, October 22, 1997. USEPA Region III, Philadelphia, Pennsylvania. October 22, 1997 Memorandum.

U. S. Environmental Protection Agency, 1992. Management of Contaminated Media. Guidance Number TSC-92-02. USEPA Region IV, Atlanta, GA. December 28,1992 Memorandum

TABLES

TABLE 2-1
Summary of Site Background Soil Concentration Ranges
and USEPA Risk Based Concentrations
Land Disposal Areas RFI
Sloss Industries Corporation

CHEMICAL	BACKGROUND CONCENTRATION RANGE	USEPA RBC SOIL INGESTION-RESIDENTIAL 1/	USEPA RBC SOIL INGESTION-INDUSTRIAL 1/	RCRA TC Level 5/
Volatile Organic Compounds (ug/kg):				
Acetone	ND	7,800,000	200,000,000	NS
Toluene	1.0-7.4	16,000,000	410,000,000	NS
Semivolatile Organic Compounds (ug/kg):				
* Acenaphthene	ND	4,700,000	120,000,000	NS
* Acenaphthylene	ND	NS	NS	NS
* Anthracene	ND	23,000,000	610,000,000	NS
* Benzo(a)anthracene	33	880	7,800	NS
* Benzo(a)pyrene	40	88	780	NS
* Benzo(b)fluoranthene	65-66	880	7,800	NS
* Benzo(g,h,i)perylene	ND	NS	NS	NS
* Benzo(k)fluoranthene	ND	8,800	78,000	NS
* Chrysene	43	88,000	780,000	NS
* Dibenzo(a,h)anthracene	ND	88	780	NS
* Fluoranthene	58-61	3,100,000	82,000,000	NS
* Fluorene	ND	3,100,000	82,000,000	NS
* Indeno(1,2,3-cd)pyrene	ND	880	7,800	NS
* Phenanthrene	30	NS	NS	NS
* Naphthalene	44-48	3,100,000	82,000,000	NS
* Pyrene	52	2,300,000	61,000,000	NS
Metals (mg/kg):				
Antimony, Total	ND	31	820	NS
Arsenic, Total	1.9-21	0.43 2/	3.8 2/	5
Barium, Total	14-200	5,500	140,000	100
Beryllium, Total	0.44-2.6	0.15	1.3	NS
Cadmium, Total	ND	39	1,000	1
Chromium, Total	8.6-46	390 3/	10,000 3/	5
Copper, Total	5.0-32	270,000	1,000,000	NS
Lead, Total	5.0-23	400	NS	5
Mercury, Total	0.034-0.15	23	610	0.2
Nickel, Total	4.7-47	1,600	41,000	NS
Silver, Total	ND	390	10,000	5
Zinc, Total	8.6-71	23,000	610,000	NS
Cyanide, Total (mg/kg):	ND	1,600	41,000	NS

ND - Not Detected. This constituent was not detected in site background soil samples.
NS - No Standard.
1/ Source: EPA Region III Risk-Based Concentrations (RBCs), October 22, 1997
2/ RBC for arsenic as a carcinogen RBC.
3/ Chromium VI RBC.
4/ TC Level concentrations are in ug/L for VOCs and SVOCs and mg/L for metals.
* Polycyclic aromatic hydrocarbon (PAH).

TABLE 3-1
Summary of Constituents Detected in Subsurface
Soil Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC	RCRA TC Level 5/	970806-LD-23-SL0021(14-16)	970806-LD-23-SL0021(20-22)	970806-LD-23-SL9021	970806-LD-23-SL0022(0-2)	970806-LD-23-SL0023(12-14)
LAB ID	Soil Ingestion-		85785-6	85785-5	85785-7	85785-2	85785-3
SAMPLE DATE	Industrial 1/		8/6/97	8/6/97	8/6/97	8/6/97	8/6/97
Volatile Organic Compounds (ug/kg):							
Acetone	200,000,000	NS	<72	<75	<77	<57	<60
Semivolatile Organic Compounds (ug/kg):			ND	ND	ND	ND	ND
Metals (mg/kg):							
Arsenic, Total	3.8 2/	5	3.6 J	2.2 J	2 J	$\boxed{4.6}$	2.9
Barium, Total	140,000	100	39 J	82	63 J	25	14
Beryllium, Total	1.3	NS	<0.7 UJ	<0.7	<0.8 UJ	<0.6	<0.6
Cadmium, Total	1,000	1	<0.7 UJ	<0.7 UJ	<0.8 UJ	<0.6 UJ	<0.6 UJ
Chromium, Total	10,000 3/	5	<1.4 UJ	9.3	15 UJ	11	<1.2
Copper, Total	1,000,000	NS	<2.9 UJ	<3	<3.1 UJ	<2.3	<2.4
Lead, Total	400 4/	5	<3.6	<3.7	<3.9	13	<3
Nickel, Total	41,000	NS	<2.9 UJ	28	23 UJ	<2.3	<2.4
Zinc, Total	610,000	NS	41	63	54	41	32
Cyanide, Total (mg/kg):	41,000	NS	0.43	0.34	0.46	<0.2	0.31
Percent Solids (%)	NS	NS	69	67	65	88	84

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TABLE 3-1
Summary of Constituents Detected in Subsurface
Soil Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC	RCRA TC Level 5/	970806-LD-23-SL0023(24-26)	970805-LD-23-SL0024(7-9)	970805-LD-23-SL0024(14-16)	970805-LD-23-SL0025(19-21)
LAB ID	Soil Ingestion-		85785-4	85657-17	85657-19	85657-16
SAMPLE DATE	Industrial 1/		8/6/97	8/5/97	8/5/97	8/5/97
Volatile Organic Compounds (ug/kg):						
Acetone	200,000,000	NS	<61	<61	<72	110
Semivolatile Organic Compounds (ug/kg):			ND	ND	ND	ND
Metals (mg/kg):						
Arsenic, Total	3.8 2/	5	6.3	13	30	3.8
Barium, Total	140,000	100	76	43	53	180
Beryllium, Total	1.3	NS	<0.6	<0.6	0.7	<0.6
Cadmium, Total	1,000	1	<0.6 UJ	2.5	2.4	<0.6
Chromium, Total	10,000 3/	5	<1.2	7	19	15
Copper, Total	1,000,000	NS	<2.5	5	22	<2.5
Lead, Total	400 4/	5	10	4.4	19	<3.2
Nickel, Total	41,000	NS	8.8	45	66	18
Zinc, Total	610,000	NS	70	83	430	47
Cyanide, Total (mg/kg):	41,000	NS	<0.3	<0.3	<0.3	<0.3
Percent Solids (%)	NS	NS	82	82	70	78

NOTE: Sample 970806-LD-23-SL9021 is the duplicate of 970806-LD-23-SL0021 (20-22)

Explanation:

J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
ND	Not detected. Analytes in this group were all below their respective detection limits.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
(open box)	Concentration exceeds Industrial RBC
(shaded box)	Concentration exceeds Industrial RBC and background soil concentrations.
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 22, 1997.
2/	RBC for Arsenic as a carcinogen.
3/	RBC for Chromium VI.
4/	Residential RBC.
5/	TC Levels for metals are in milligrams per liter (mg/L).

TABLE 3-2
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

			SWMU 38						
SAMPLE ID	USEPA RBC Soil Ingestion-Industrial[1/]	RCRA TC Level [5/]	970804-LD-38-SL0026(10-12)	970804-LD-38-SL9026	970804-LD-38-SL0026(18-20)	970805-LD-38-SL0027(11-13)	970805-LD-38-SL0027(22-24)	970808-LD-38-SL0027(22-24)	970807-LD-38-SL0028(8-10)
LAB ID			85657-5	85657-8	85657-6	85657-13	85657-14	85785-18	85785-12
SAMPLE DATE			8/4/97	8/4/97	8/4/97	8/5/97	8/5/97	8/8/97	8/7/97
Volatile Organic Compounds (ug/kg):									
Toluene	410,000,000	NS	<7	8	<6	<6	NA	<7	<7
Semivolatile Organic Comounds (ug/kg):			ND	ND	ND	ND	ND	NA	ND
Metals (mg/kg):									
Antimony, Total	820	NS	<6.7	<6.7	<5.9	<6.1	<7.6	NA	9.6
Arsenic, Total	3.8[2/]	5	3.3 J	3.5 J	1.8 J	4.1	2.3	NA	<1.3
Barium, Total	140,000	100	110	110	99	8.6	17	NA	19
Beryllium, Total	1.3	NS	1.9	1.6	<0.6	<0.6	<0.8	NA	<0.6
Chromium, Total	10,000[3/]	5	9.3	8.5	15	15	2.4	NA	15
Copper, Total	1,000,000	NS	6.5	15	6.5	<2.4	<3	NA	6.1
Lead, Total	400[4/]	5	6.4	5.5	<3	<3	<3.8	NA	7.9
Nickel, Total	41,000	NS	32	29	20	<2.4	4.4	NA	<2.7
Silver, Total	10,000	5	<1.3 UJ	<1.3 UJ	<1.2 UJ	<1.2 UJ	<1.5 UJ	NA	<1.3 UJ
Zinc, Total	610,000	NS	76	51	60	23	18	NA	31
Cyanide, Total (mg/kg):	41,000	NS	<0.3	<0.3	<0.2	<0.2	<0.3	NA	<0.3
Percent Solids (%)	NS	NS	76	76	87	83	66	72	75

Footnotes on Page 3

TABLE 3-2
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

			SWMU 38						
SAMPLE ID	USEPA RBC Soil Ingestion-Industrial[1/]	RCRA TC Level[5/]	970807-LD-38-SL0028(13-15)	970807-LD-38-SL0029(15-17)	970807-LD-38-SL0029(19-21)	970807-LD-38-SL0030(9-11)	970807-LD-38-SL0030(17-19)	970808-LD-38-SL0037(4-6)	970808-LD-38-SL0037(8-10)
LAB ID			85785-14	85785-10	85785-11	85785-8	85785-9	85785-21	85785-20
SAMPLE DATE			8/7/97	8/7/97	8/7/97	8/7/97	8/7/97	8/8/97	8/8/97
Volatile Organic Compounds (ug/kg):									
Toluene	410,000,000	NS	<7	<7	<7	<6	<7	<7	<7
Semivolatile Organic Comounds (ug/kg):			ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg):									
Antimony, Total	820	NS	<6.8	<6.7	<6.7	<5.9	<6.7	<6.7	<6.7
Arsenic, Total	3.8[2/]	5	1.8	<1.3	2.1	4.3 J	5.1 J	2	3.5
Barium, Total	140,000	100	120	70	130	61	130	2.4	94
Beryllium, Total	1.3	NS	<0.7	<0.7	2.8	<0.6 UJ	<0.8 UJ	<0.7	<0.7
Chromium, Total	10,000[3/]	5	10	6	3.1	9.4	11	19	5.7
Copper, Total	1,000,000	NS	<2.7	5.2	5.5	<2.3 UJ	110 J	<2.7	<2.7
Lead, Total	400[4/]	5	36	5	<3.4	<2.9	<3.3	9.4	11
Nickel, Total	41,000	NS	23	5.4	24	<2.3	<2.7	<2.7	3
Silver, Total	10,000	5	<1.4 UJ	<1.3 UJ	<1.3 UJ	<1.2	7.6	<1.3 UJ	<1.3 UJ
Zinc, Total	610,000	NS	62	47	79	54	190	10	63
Cyanide, Total (mg/kg):	41,000	NS	<0.3	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3
Percent Solids (%)	NS	NS	74	75	75	86	75	75	75

Footnotes on Page 3

TABLE 3-2
Summary of Constituents Detected in Subsurface Soil Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

			SWMU 39						
SAMPLE ID	USEPA RBC Soil Ingestion-Industrial[1/]	RCRA TC Level [5/]	970808-LD-39-SL0033(11-13)	970805-LD-39-SL0034(10-12)	970808-LD-39-SL0034(10-12)	970808-LD-39-SL0035(10-12)	970804-LD-39-SL0036(5-7)	970804-LD-39-SL9036	970804-LD-39-SL0036(10-12)
LAB ID			85785-23	85657-15	85785-19	85785-22	85657-2	85657-7	85657-4
SAMPLE DATE			8/8/97	8/5/97	8/8/97	8/8/97	8/4/97	8/4/97	8/4/97
Volatile Organic Compounds (ug/kg):									
Toluene	410,000,000	NS	<6	NA	<6	<7	<6	<6	<7
Semivolatile Organic Comounds (ug/kg):			ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg):									
Antimony, Total	820	NS	<6.2	<6	NA	<7.5	<6	<6.1	<7.3
Arsenic, Total	3.8[2/]	5	5	5.2	NA	2.7	4.2	3.5 J	4.8
Barium, Total	140,000	100	420	180	NA	130	140	140	110
Beryllium, Total	1.3	NS	<0.6	<0.6	NA	<0.7	<0.6	<0.6	<0.7
Chromium, Total	10,000[3/]	5	10	13	NA	11	8.9	7.9	11
Copper, Total	1,000,000	NS	4.3	<2.4	NA	<3	16	21	9.3
Lead, Total	400[4/]	5	9.3	10	NA	7.9	28	16	6
Nickel, Total	41,000	NS	22	6	NA	9.3	7.1	7.2	11
Silver, Total	10,000	5	<1.2 UJ	<1.2 UJ	NA	<1.5 UJ	<2.1 UJ	<1.2 UJ	<1.5 UJ
Zinc, Total	610,000	NS	53	46	NA	57	58	57	96
Cyanide, Total (mg/kg):	41,000	NS	1.25	0.7	NA	<0.3	<0.2	<0.2	<0.3
Percent Solids (%)	NS	NS	82	83	84	67	84	83	69

NA Not Analyzed NS No Standard
ND Not detected. Analytes in this group were all below their respective detection limits.
J Positive results have been classified as qualitative during data validation.
U Classified as nondetected.
ug/kg Micrograms per kilogram.
mg/kg Milligrams per kilogram.
[1/] Source: USEPA Region III Risk Based Concentrations (RBC), October 22, 1997
[2/] RBC for Arsenic as a carcinogen.
[3/] RBC for chromium VI
[4/] Residential RBC
[5/] RCRA TC Levels for metals are in milligrams per liter (mg/L).
Concentration exceeds USEPA Industrial RBC
Concentration exceeds USEPA Industrial RBC and background soil concentration.
Note: Sample 970804-LD-38-SL9025 is the duplicate of 970804-LD-38-SL0025(10-12);
Sample 970804-LD-39-SL9036 is the duplicate of 970804-LD-39-SL0036(5-7).

TABLE 3-3
Summary of Constituents Detected in Investigation
Derived Waste Soil Samples Collected in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA RBC Soil Ingestion-	RCRA TC Level 5/	970822-LD-IW-SL0021	970822-LD-IW-SL0029	970822-LD-IW-SL0031	970822-LD-IW-SL0032	970822-LD-IW-SL0033	970822-LD-IW-SL0035	970822-LD-IW-SL0037	970822-LD-IW-SL9999
LAB ID	Industrial 1/		86235-1	86235-10	86235-7&-8	86235-9	86235-5 & -6	86235-2 & -3	86235-4	86235-11 & -12
SAMPLE DATE			8/22/97	8/22/97	8/22/97	8/22/97	8/22/97	8/22/97	8/22/97	8/22/97
Volatile Organic Compounds (ug/kg):										
Toluene	410,000,000	NS	<6	<7	<6	7	<6	<6	<6	28
Xylenes	1,000,000,000	NS	<6	<7	<6	<6	<6	<6	<6	7
Semivolatile Organic Compounds (ug/kg):										
Anthracene	610,000,000	NS	<380	<430	<430	<380	<430	710	<410	<330
Benzo(a)anthracene	7,800	NS	<380	<430	<430	500	<430	1900	<410	380
Benzo(a)pyrene	780	NS	<380	<430	<430	420	<430	1400	<410	<330
Benzo(b)fluoranthene	7,800	NS	<380	<430	<430	<380	<430	1000	<410	<330
Benzo(g,h,i)perylene	NS	NS	<380	<430	<430	410	<430	1100	<410	<330
Benzo(k)fluoranthene	78,000	NS	<380	<430	<430	500	<430	1400	<410	400
Bis(2-ethylhexyl)phthalate	410,000	NS	1400	<430	<430	2000	<430	400	<410	3200
Chrysene	780,000	NS	<380	<430	<430	550	<430	1800	<410	460
Fluoranthene	82,000,000	NS	<380	<430	<430	830	<430	2300	<410	720
Fluorene	82,000,000	NS	<380	<430	<430	<380	<430	620	<410	<330
Indeno(1,2,3-cd)pyrene	7,800	NS	<380	<430	<430	<380	<430	950	<410	<330
Naphthalene	82,000,000	NS	<380	<430	<430	<380	<430	700	<410	<330
Phenanthrene	NS	NS	<380	<430	<430	760	<430	2000	<410	450
Pyrene	61,000,000	NS	<380	<430	<430	1100	<430	2700	<410	840
Metals (mg/kg):										
Antimony, Total	820	NS	<5.7 UJ	<6.5 UJ	<6.6 UJ	7 J	<6.6 UJ	<5.4 UJ	<6.3 UJ	<5.1 UJ
Arsenic, Total	3.8 2/	5	<1 UJ	<1 UJ	2.9 J	6.3 J	3.8 J	1.8 J	<1 UJ	4.2 J
Barium, Total	140,000	100	45 J	22 J	92 J	290 J	140 J	120 J	19 J	110 J
Beryllium, Total	1.3	NS	<0.6 UJ	<0.7 UJ	1.2 J	1 J	1.7 J	0.9 J	0.8 J	0.9 J
Cadmium, Total	1,000	1	1.7 J	<0.7 UJ	17 J	34 J	23 J	3.8 J	1.6 J	11 J
Chromium, Total	10,000 3/	5	7.9 J	3 J	<1.3 UJ	220 J	22 J	5.5 J	1.6 J	32 J
Copper, Total	82,000	NS	13 J	5.7 J	97 J	270 J	86 J	19 J	13 J	120 J

TABLE 3-3
Summary of Constituents Detected in Investigation
Derived Waste Soil Samples Collected in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID LAB ID SAMPLE DATE	USEPA RBC Soil Ingestion- Industrial [1/]	RCRA TC Level [5/]	970822-LD-IW-SL0021 86235-1 8/22/97	970822-LD-IW-SL0029 86235-10 8/22/97	970822-LD-IW-SL0031 86235-7&-8 8/22/97	970822-LD-IW-SL0032 86235-9 8/22/97	970822-LD-IW-SL0033 86235-5 & -6 8/22/97	970822-LD-IW-SL0035 86235-2 & -3 8/22/97	970822-LD-IW-SL0037 86235-4 8/22/97	970822-LD-IW-SL9999 86235-11 & -12 8/22/97
Metals continued (mg/kg):										
Lead, Total	400 [4/]	5	<2.9 UJ	<3.3 UJ	99 J	360 J	120 J	36 J	<3.1 UJ	99 UJ
Mercury, Total	610	0.2	<0.25	<0.25	<0.25	0.4	<0.25	<0.25	<0.25	<0.25
Nickel, Total	41,000	NS	15 J	5.9 J	19 J	110 J	18 J	5.6 J	4.6 J	16 J
Silver, Total	10,000	5	<1.1 UJ	<1.3 UJ	2.4 J	3 J	1.4 J	<1.1 UJ	<1.3 UJ	<1 UJ
Zinc, Total	610,000	NS	35 J	16 J	1000 J	1800 J	1300 J	88 J	35 J	580 J
Cyanide, Total (mg/kg):	41,000	NS	<0.2	<0.3	2.3	2.8	4	1.9	0.3	3.5
Percent Solids (%)	NS	NS	88	77	76	87	76.1	92.7	79.6	97.4

Explanation:

J	Positive results have been classified as qualitative during data validation.
UJ	Analyte was not detected at or above the indicated concentration and has been classified as qualitative.
ug/kg	Micrograms per kilogram.
mg/kg	Milligrams per kilogram.
(box)	Concentration exceeds Industrial RBC
(shaded box)	Concentration may exceed RCRA TC Level
1/	Source: USEPA Region III Risk Based Concentrations (RBC), October 22, 1997.
2/	RBC for Arsenic as a carcinogen.
3/	RBC for Chromium VI.
4/	Residential RBC.
5/	TC Level concentrations are in micrograms per liter (ug/L) for VOCs and SVOCs and in milligrams per liter (mg/L) for metals.

TABLE 3-4
Summary of Constituents Detected in Groundwater
Samples Collected at SWMU 23 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

SAMPLE ID	USEPA MCL	RCRA TC Level	970818-LD-23-GW0021	970818-LD-23-GW0022	970818-LD-23-GW0023	970818-LD-23-GW0024	970819-LD-23-GW0025D	970819-LD-23 GW9025D	970819-LD-23-GW0025S
LAB ID			86126-2	86126-1	86126-3	86126-4	86126-7	86126-12	86126-11
SAMPLE DATE			35660	35660	35660	35660	35661	35661	35661
Volatile Organic Compounds(ug/L)									
Acetone	3,700 [1/]	NS	<50	110	<50	<50	<50	<50	<50
Semivolatile Organic Compounds(ug/L)			ND	ND	ND	ND	ND	ND	ND
Metals (mg/L):									
Barium, Total	2	100	0.14	0.05	0.09	0.07	0.28	0.29	0.1
Chromium, Total	0.1	5	0.02	<0.01	0.01	0.01	0.03	0.03	<0.01
Copper, Total	1.3	NS	<0.02	<0.02	<0.02	<0.02	0.02	0.02	0.02
Nickel, Total	0.1	NS	0.02	<0.02	<0.02	0.02	0.04	0.04	<0.02
Zinc, Total	5	NS	<0.02	0.05	0.11	0.09	0.09	0.11	0.06
Cyanide, Total (mg/L):	0.2	NS	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

ND = Not Detected

[1/] USEPA Region III Risk Based Concentration (RBC) for tap water, October 22, 1997

T. ⌊E 3-5
Summary of Constituents Detected in Groundwater Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

			SWMU 38						
SAMPLE ID	USEPA MCL	RCRA TC Level	970821-LD-38-GW0026	970819-LD-38-GW0027	970819-LD-38-GW0028	970819-LD-38-GW0029	970821-LD-38 GW0030D	970821-LD-38 GW0030S	970821-LD-38-GW0037
LAB ID			86173-19	86173-2	86126-14	86126-13	86173-17	86173-15	86173-11
SAMPLE DATE			8/21/97	8/19/97	8/19/97	8/19/97	8/21/97	8/21/97	8/21/97
Volatile Organic Compounds (ug/L):									
Acetone	3,700[1/]	NS	120	<50	<50	<50	120	1000	<50
Benzene	5	500	$\boxed{13}$	<5	<5	<5	<5	<5	<5
Toluene	1,000	NS	7	<2	<2	<2	<2	<2	<2
Trichloroethene	5	500	<2	<2	<2	3	<2	<2	<2
Xylenes	10,000	NS	23	<5	<5	<5	<5	<5	<5
Semivolatile Organic Compounds (mg/L):			ND	ND	ND	ND	ND	ND	ND
Metals (mg/L):									
Barium, Total	2	100	0.26	0.08	0.14	0.51	0.5	0.13	0.07
Chromium, Total	0.1	5	0.02	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Copper, Total	1.3	NS	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
Zinc, Total	5	NS	0.2	<0.02	<0.02	0.06	<0.02	0.18	0.05
Lead, Total	0.015	5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Silver, Total	0.1	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide, Total (mg/L)	0.2	NS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

LE 3-5

Summary of Constituents Detected in Groundwater Samples
Collected at SWMUs 38 and 39 in August 1997
Land Disposal Areas RFI
Sloss Industries Corporation

			SWMU 39							
SAMPLE ID	USEPA MCL	RCRA TC Level	970821-LD-39-GW0031	970821-LD-39-GW0032	970820-LD-39-GW0033	970821-LD-39-GW0034D	970820-LD-39-GW0034S	970820-LD-39-GW9034S	970821-LD-39-GW0035	970821-LD-39-GW0036
LAB ID			86173-13	86173-14	86173-8	86173-18	86173-6	86173-7	86173-12	86173-9
SAMPLE DATE			8/21/97	8/21/97	8/20/97	8/21/97	8/20/97	8/20/97	8/21/97	8/21/97
Volatile Organic Compounds (ug/L):										
Acetone	3,700[1/]	NS	120	<50	<50	66	<50	<50	<50	<50
Benzene	5	500	<5	<5	<5	6	<5	<5	<5	<5
Toluene	1,000	NS	<2	<2	<2	<2	<2	<2	<2	<2
Trichloroethene	5	500	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes	10,000	NS	<5	<5	<5	7	<5	<5	<5	<5
Semivolatile Organic Compounds (mg/L):			ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/L):										
Barium, Total	2	100	0.12	0.03	0.1	0.03	0.02	0.02	0.07	0.02
Chromium, Total	0.1	5	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Copper, Total	1.3	NS	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
Zinc, Total	5	NS	<0.02	<0.02	<0.02	0.21	<0.02	<0.02	<0.02	0.05
Lead, Total	0.015	5	<0.025	<0.025	<0.025	0.04	<0.025	<0.025	<0.025	<0.025
Silver, Total	0.1	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24
Cyanide, Total (mg/L)	0.2	NS	0.03	0.38	0.14	<0.02	0.21	0.22	0.07	<0.02

ND — Not detected. Analytes in this group were all below their respective detection limits.
mg/L — Milligrams per liter.
ug/L — Micrograms per liter.
[1/] Source: USEPA Region III Risk Based Concentrations (RBC) for tap water, October 22, 1997
[ ] Concentration exceeds USEPA MCL.

j:/Proj/TF320/Landdisp/rpt/IDW/3839gidw.xls
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ARCADIS GERAGHTY & MILLER

TABLE 3-6
IDW Rock and/or Soil Cutting Characterization
Land Disposal Areas RFI
Sloss Industries Corporation

Location	Sample ID	Number of Drums	Cutting Material	Characterization			Proposed Management Practice		
				Concentration May Exceed RCRA TC Level	Concentration Exceeds USEPA RBC for Industrial Ingestion	Concentrations Do Not Exceed USEPA RBCs for Industrial Ingestion	Dispose of as Hazardous Waste	Dispose of as Contaminated Medium	Place Cuttings in Land Disposal Area at Sloss
MW-21	970822-LD-IW-SL0021	1	CL & LS			X			X
MW-29	970822-LD-IW-SL0029	1	CL, LS, SD			X			X
MW-31	970822-LD-IW-SL0031	3	LS & FD			X			X
39-SBMW32	970822-LD-IW-SL0032	1	FD	X			X		
MW-33	970822-LD-IW-SL0033	3	FD & LS	X			X		
MW-35	970822-LD-IW-SL0035	2	CL & LS		X			X	
MW-37	970822-LD-IW-SL0037	1	LS			X			X
Decon Pad	970822-LD-IW-SL9999	3	CL & V			X			X

Note: Sample 970822-LD-IW-SL0032 was collected from the drum of overburden material containerized while drilling soil boring 38-SBMW32 which is mainly sludge from SWMU 39 or flue dust.

CL - Clay
LS - Limestone
FD - Flue Dust (Sludge)
SD - Sand
V - Visquene

TABLE 3-7
IDW Soil Cutting Characterization
Land Disposal Areas RFI
Sloss Industries Corporation

SWMU	Location Name	Sample ID	Number of Drums	Characterization: Concentration Exceeds USEPA RBC for Industrial Ingestion or Background Soil Range	Characterization: Concentration Does Not Exceed USEPA RBC for Industrial Ingestion or Background Soil Range	Proposed Management Practice: Dispose of as Hazardous Waste	Proposed Management Practice: Dispose of as Contaminated Medium	Proposed Management Practice: Place Cuttings in Land Disposal Area at Sloss
23	*MW-21*	970806-LD-23-SL0021(14-16)	1		X			X
		970806-LD-23-SL0021(20-22)			X			
		970806-LD-23-SL9021(duplicate)			X			
	23-SB*MW22*	970806-LD-23-SL0022(0-2)	0		X			
	23-SB*MW23*	970806-LD-23-SL0023(12-14)	1		X			X
		970806-LD-23-SL0023(24-26)			X			
	23-SB*MW24*	970805-LD-23-SL0024(7-9)	1		X		X	
		970805-LD-23-SL0024(14-16)		X				
	23-SB*MW25*	970805-LD-23-SL0025(19-21)	1		X			X
38	38-SB*MW26*	970804-LD-38-SL0026(10-12)	1		X			X
		970804-LD-38-SL9026 (duplicate)			X			
		970804-LD-38-SL0026(18-20)			X			
	38-SB*MW27*	970805-LD-38-SL0027(22-24)	2		X			X
		970808-LD-38-SL0027(22-24) [1/]			X			
		970805-LD-38-SL0027(11-13)			X			
	38-SB*MW28*	970807-LD-38-SL0028(8-10)	2		X			X
		970807-LD-38-SL0028(13-15)			X			
	MW-29	970807-LD-38-SL0029(15-17)	1		X		X	
		970807-LD-38-SL0029(19-21)		X				
	38-SB*MW30*	970807-LD-38-SL0030(9-11)	1		X			X
		970807-LD-38-SL0030(17-19)			X			
	MW-31	Soil samples were not collected.						
	MW-37	970808-LD-38-SL0037(4-6)	1		X			X
		970808-LD-38-SL0037(8-10)			X			
39	39-SB*MW32*	Soil samples were not collected.						
	MW-33	970808-LD-39-SL0033(11-13)	1		X			X
	39-SB*MW34*	970805-LD-39-SL0034(10-12)	2		X			X
		970808-LD-39-SL0034(10-12) [1/]			X			
	MW-35	970808-LD-39-SL0035(10-12)	[2/]		X			
	39-SB*MW36*	970804-LD-39-SL0036(5-7)	1		X			X
		970804-LD-39-SL9036 (duplicate)			X			
		970804-LD-39-SL0036(10-12)			X			

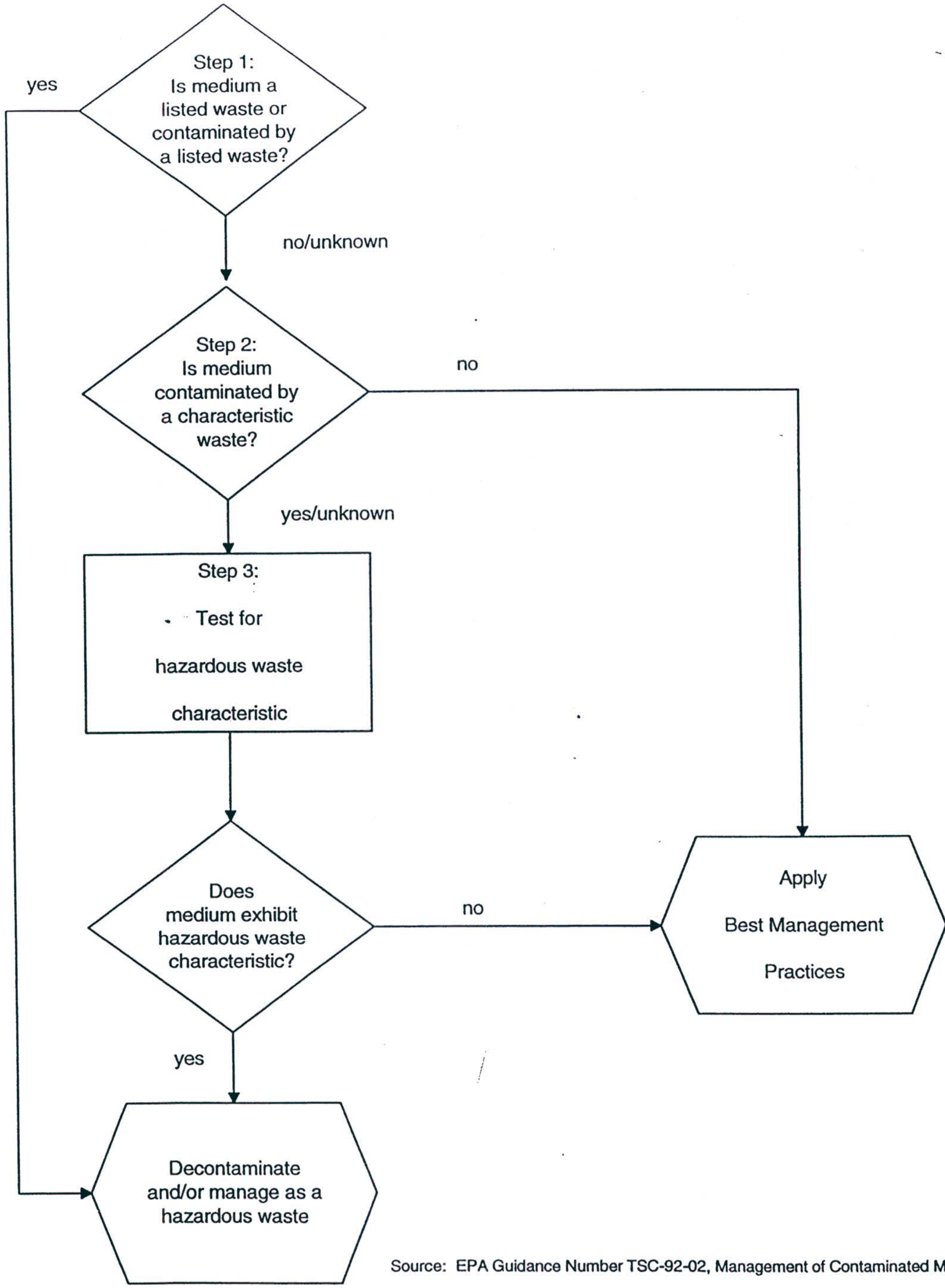
[1/] VOC sample was recollected because sample bottle was broken during shipment.

[2/] Soil cuttings and rock cuttings were mixed so soil data could not be used to characterize drums. See Table 3-6.

TABLE 3-8
IDW Purge Water Characterization
Land Disposal Areas RFI
Sloss Industries Corporation

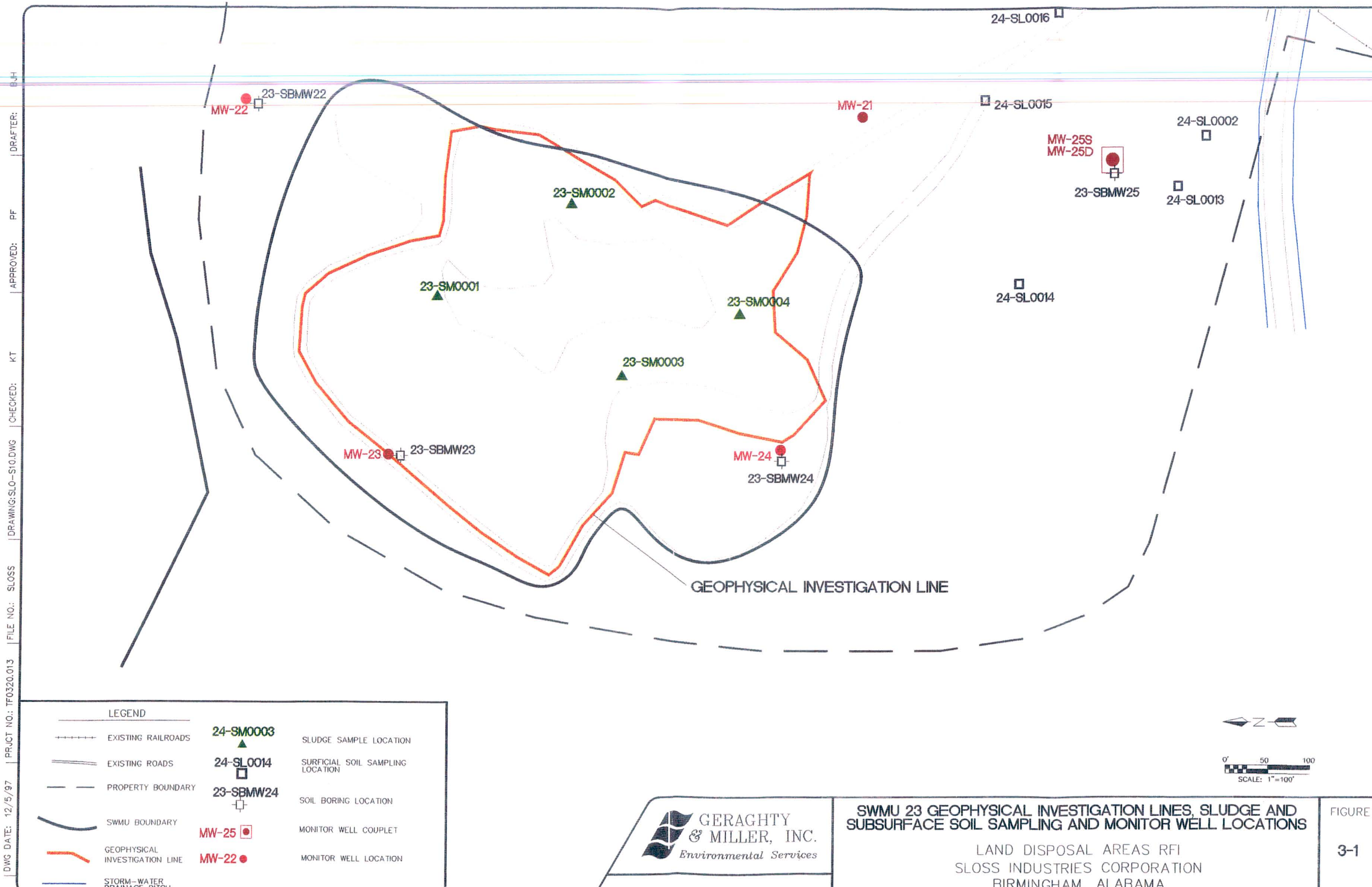
Location	Sample ID	Number of Drums	Characterization: Concentration Exceeds USEPA MCL or RBCs for Tap Water	Characterization: Concentrations Do Not Exceed USEPA MCLs or RBCs for Tap Water	Proposed Management Practice: Dispose of as Hazardous Waste	Proposed Management Practice: Dispose of as Contaminated Medium	Proposed Management Practice: Dispose of Purge Water at BTF
MW-21	970818-LD-23-GW0021	2		X			X
MW-22	970818-LD-23-GW0022	1		X			X
MW-23	970818-LD-23-GW0023	1		X			X
MW-24	970818-LD-23-GW0024	1		X			X
MW-25D	970819-LD-23-GW0025D	1		X			X
MW-25S	970819-LD-23-GW0025S	1		X			X
MW-26	970821-LD-38-GW0026	1	X			X	
MW-27	970819-LD-38-GW0027	1		X			X
MW-28	970819-LD-38-GW0028	1		X			X
MW-29	970819-LD-38-GW0029	2		X			X
MW-30D	970821-LD-38-GW0030D	1		X			X
MW-30S	970821-LD-38-GW0030S	1		X			X
MW-31	970821-LD-39-GW0031	2		X			X
MW-32	970821-LD-39-GW0032	1	X			X	
MW-33	970820-LD-39-GW0033	3		X			X
MW-34S	970820-LD-39-GW0034S	1	X			X	
MW-34D	970821-LD-39-GW0034D	1	X			X	
MW-35	970821-LD-39-GW0035	1		X			X
MW-36	970821-LD-39-GW0036	2	X			X	
MW-37	970821-LD-38-GW0037	3		X			X

FIGURES



Source: EPA Guidance Number TSC-92-02, Management of Contaminated Media

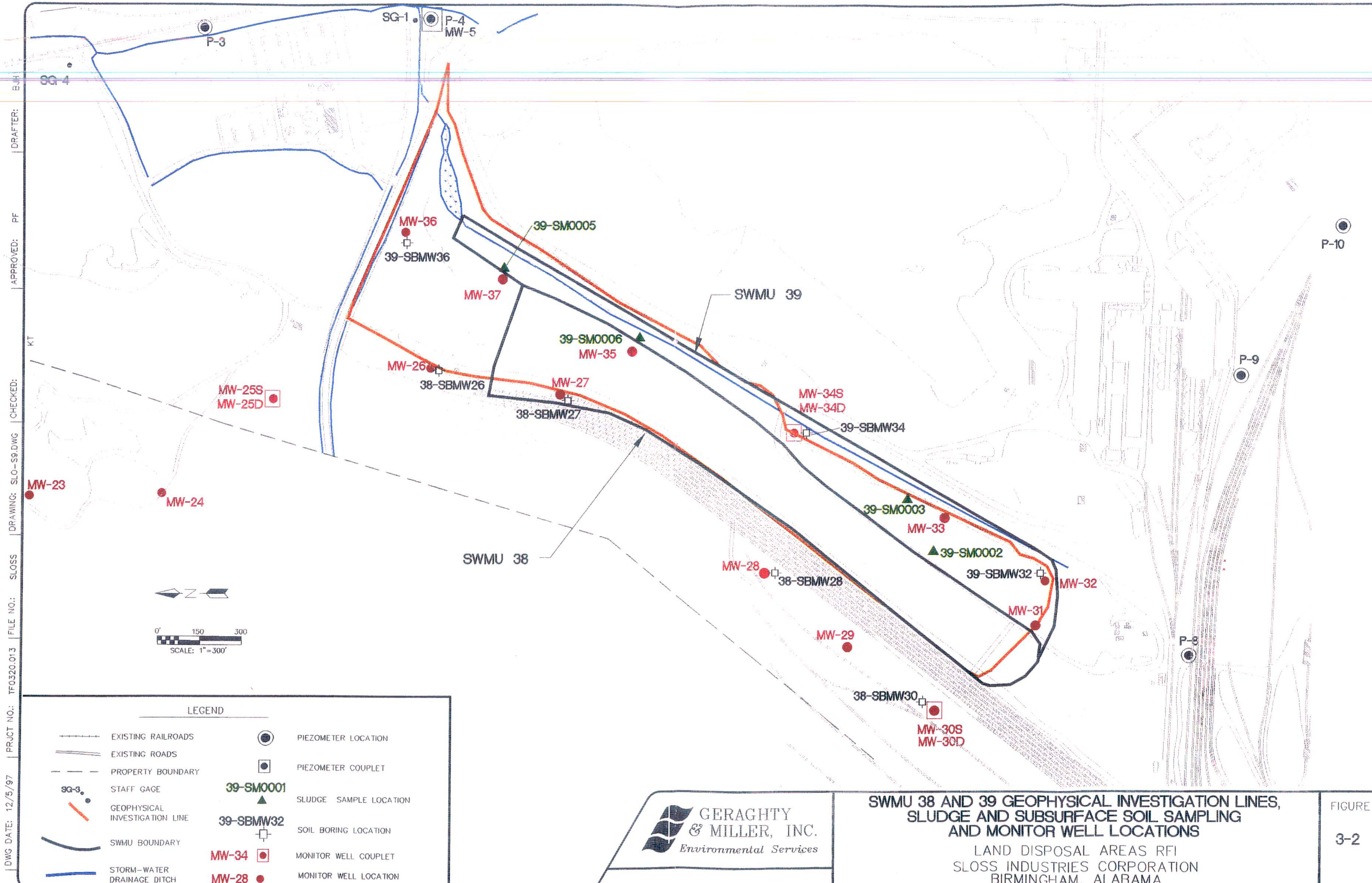
GERAGHTY & MILLER, INC. Environmental Services a heidemij company	DECISION MATRIX FOR MANAGING CONTAMINATED MEDIA	FIGURE 2-1



SWMU 23 GEOPHYSICAL INVESTIGATION LINES, SLUDGE AND SUBSURFACE SOIL SAMPLING AND MONITOR WELL LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

FIGURE 3-1



SWMU 38 AND 39 GEOPHYSICAL INVESTIGATION LINES, SLUDGE AND SUBSURFACE SOIL SAMPLING AND MONITOR WELL LOCATIONS

LAND DISPOSAL AREAS RFI
SLOSS INDUSTRIES CORPORATION
BIRMINGHAM, ALABAMA

APPENDIX A

USEPA GUIDANCE NUMBER TSC-92-02
MANAGEMENT OF CONTAMINATED MEDIA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

MEMORANDUM

DATE: DEC 28 1992

SUBJECT: Guidance Number TSC-92-02
Management of Contaminated Media

FROM: G. Alan Farmer
Chief, RCRA Branch Alan Farmer

TO: Addressees

Attached please final guidance developed by the EPA Region IV RCRA Technical Screening Committee regarding management of contaminated groundwater, surface water and soils. This guidance expands upon the existing "contained-in" policy and also addresses management of environmental media exhibiting a hazardous characteristic.

This guidance should be followed by EPA Region IV staff and all others who actively manage contaminated environmental media within Region IV during any of the following RCRA activities:

- Corrective actions;
- Site investigations;
- Clean up of hazardous waste spills; and
- Closure of RCRA treatment, storage or disposal units.

In addition, this guidance represents an interpretation of RCRA regulations and as such should be considered in evaluating ARARs for CERCLA activities.

The Technical Screening Committee would like to thank everyone who commented on the draft for their contributions to the guidance.

Attachment

Addressees:

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EPA REGION IV RCRA GUIDANCE:
MANAGEMENT OF CONTAMINATED MEDIA
Guidance Number TSC-92-02
August 1992

I. Introduction

On several previous occasions, EPA has issued directives and guidance addressing the regulatory status and proper disposition of contaminated environmental media under the Resource Conservation and Recovery Act (RCRA). However, Region IV continues to receive inquiries from the States and the regulated community requesting more detailed guidance on this subject. This document explains how to properly manage contaminated environmental media (i.e., groundwater, surface water, soils and sediments) during routine field work at hazardous waste sites.

It is important to emphasize that this guidance is only intended to be an interpretation of RCRA regulations. Nothing in this guidance is intended to change or supersede actual RCRA regulatory requirements. Several anticipated rulemakings relate to this guidance, including the Land Disposal Restrictions for Contaminated Soil and Debris and the Hazardous Waste Identification Rule. If any provisions of these future RCRA regulations are in conflict with this guidance, the regulations (once final) will take precedent. 1/

II. Scope and Applicability

This guidance sets forth procedures for the proper management of contaminated environmental media produced and/or managed during the investigation and remediation of hazardous waste sites. Contaminated media should be managed in accordance with this guidance whenever hazardous constituents are present above levels of human health or environmental concern.

This guidance applies to contaminated media generated during the following RCRA activities:

1. corrective actions;
2. site investigations;
3. clean up of spills of listed or characteristic hazardous waste; and
4. closure of RCRA treatment, storage, or disposal units.

1/ The policies and procedures established in this document are intended solely for the guidance of employees of the U.S. Environmental Protection Agency. They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the the United States. EPA reserves the right to act at variance with these policies and procedures and to change them at any time without public notice.

The procedures and management practices set forth in this guidance should be followed by EPA Region IV and all others who actively manage contaminated media at sites within the Region, regardless of whether such management activities are voluntary or carried out in response to EPA regulations or directives.

III. Background

The regulatory status of contaminated groundwater was first specifically addressed in a December 26, 1984, memorandum from John Skinner, Director of the Office of Solid Waste to James Scarbrough, Region IV Residuals Management Branch Chief. In that memorandum, Skinner noted that contaminated groundwater that is "collected" and derived from listed wastes or hazardous by characteristic is a hazardous waste and subject to Subtitle C regulations.

A November 13, 1986, memorandum from Marcia Williams, Director of the Office of Solid Waste to Patrick Tobin, Region IV Waste Management Division Director attempted to more precisely explain the EPA position on contaminated groundwater presented by Skinner. The Williams memorandum explained what is now referred to as the "contained-in" policy. Williams stated that groundwater in an aquifer is not a solid waste and thus not a hazardous waste, but that groundwater contaminated with hazardous waste leachate is subject to RCRA Subtitle C regulations because it "contains" a hazardous waste and therefore must be managed as if the groundwater itself was hazardous. However, if groundwater is treated such that it no longer contains a hazardous waste, the groundwater would no longer be subject to regulation under Subtitle C of RCRA.

Subsequent to the 1986 Williams memorandum, the scope of the "contained-in" policy has been applied to contaminated soil, debris, and leachate. For example, in the Land Disposal Restrictions (LDR) First Third Final Rule (53 FR 31142) the Agency clarified the applicability of the LDR treatment standards to residues from types of management other than treatment. 2/ Examples cited by EPA are contaminated soil or leachate derived from managing the waste. EPA stated: "In these cases, the <u>mixture</u> is deemed to be the listed waste, either because of the derived-from rule, the mixture rule (40 CFR §261.3(a)(2)(iv)), or because the listed waste is <u>contained in</u> the matrix...". 3/

2/ Residuals from treatment of listed hazardous waste have always been considered hazardous waste by application of the derived-from rule (40 CFR §261.3(c)(2)(i)).

3/ The reference to contaminated soil and leachate as "the mixture" does not mean that contaminated medium is considered hazardous waste by application of the mixture rule. However, the contained-in policy is, in fact, analogous to the mixture rule, involving mixtures of hazardous

(continued. . .)

In a June 19, 1989, letter to Thomas C. Jorling, Commissioner of the New York Department of Environmental Conservation from Jonathan Cannon, Acting Assistant Administrator, EPA reiterated the basis for EPA's authority to regulate contaminated environmental media under Subtitle C of RCRA. Referring to the "mixture" rule and "derived-from" rule, Cannon states

> ...However, these two rules do not pertain to contaminated environmental media. Under our regulations, contaminated media are not considered solid wastes in the sense of being abandoned, recycled, or inherently waste-like as those terms are defined in the regulations. Therefore, contaminated environmental media cannot be considered a hazardous waste via the "mixture" rule (i.e., to have a hazardous waste mixture, a hazardous waste must be mixed with a solid waste per 40 CFR §261.3(a)(2)(iv)). Similarly, the "derived-from" rule does not apply to contaminated media. Our basis for stating that contaminated environmental media must be managed as hazardous waste is that they "contain" listed hazardous waste. These environmental media must be managed as hazardous waste because and only so long as, they "contain" a listed hazardous waste (i.e., until decontaminated).

IV. Regional Interpretation

All currently available EPA policy pertains to environmental media known to be contaminated with a listed hazardous waste. These documents collectively make up the "contained-in" policy. However, the "contained-in" policy does not address contamination from characteristic hazardous waste. Furthermore, in practice there are many times where there is no clear documentation that an environmental medium was contaminated by either a listed or characteristic hazardous waste (as is often the case at solid waste management units). Because we routinely encounter contaminated media situations beyond the scope of the traditional "contained-in" policy, it is appropriate to clarify by establishing a general definition of "contaminated" media.

EPA Region IV has established that the criteria used to determine if media requires controlled management is based upon human health and environmental risk. By definition a medium is "contaminated" if one or more hazardous constituents, as identified in 40 CFR Part 261 Appendix VIII, are present above levels of human health or environmental concern and above naturally occurring (background) levels (this is specifically for areas where there are naturally occurring high levels of Appendix VIII constituents). Contaminated environmental media should either be managed in accordance with RCRA Subtitle C requirements or "best management

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3/(continued. . .)

waste and non-waste materials while the mixture rule governs mixtures of hazardous and solid waste. The mixture rule has been codified, but the interpretive contained-in policy has the same regulatory effect. The interpretation that media containing hazardous waste must be regulated as hazardous waste was upheld in Chemical Waste Management v. U.S. EPA, 869 F.2d 1526, 1540 (D.C. Cir. 1989).

practices" as specified in Section V of this guidance. However, if a contaminated medium is treated to at or below risk-based standards (or to naturally occurring background levels), it can be rendered "decontaminated."

Risk-based levels for hazardous constituents should be derived on a site-specific basis with the aid of a toxicologist (and an ecologist, where appropriate). It is not possible or appropriate for the Region to establish generic "de minimis" levels for constituents absent a new rulemaking. Human health protection limits should be calculated using reference toxicity values for cancer and noncancer effects (i.e., carcinogenic potency factors (CPFs) and reference doses (RfDs), respectively), and exposure rate and route assumptions appropriate to site conditions. Consideration of contaminant attenuation is not an appropriate substitute for direct exposure assumptions in determining decontamination levels for environmental media. This is because a decontaminated medium under this guidance is not subject to controlled management (as opposed to non-hazardous or delisted solid waste, which under Subtitle D of RCRA remains subject to regulatory control). However, consideration of fate and transport for possible leaching to groundwater is necessary to ensure that a contaminated soil is treated to below risk-based standards for all exposure pathways. The RCRA RFI Guidance and the CERCLA Risk Assessment Guidance (RAG) should be consulted for further explanation on risk evaluations.

Once an environmental medium is determined to be "contaminated", knowledge of how the medium became contaminated dictates how that medium must be managed. The attached decision matrix is provided to assist the user in making the correct regulatory decision for management of contaminated media. A contaminated medium must ultimately be managed one of two ways: 1) as if it were a hazardous waste, or 2) in accordance with "best management practices." The discussion below explains the decision matrix logic.

A medium contaminated by listed hazardous waste clearly falls within the scope of the "contained-in" policy (Step 1 on the decision matrix). As established in Section III, the listed hazardous waste is "contained-in" the medium. The P- and U- waste listings represent a special situation whereby contaminated media are listed hazardous wastes. As stated in 40 CFR §261.33(d):

> Any residues or contaminated soil, water or other debris resulting from the cleanup of a spill into or on the land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill, into or on the land of any off-specification chemical product and would have the generic name listed in paragraph (e) or (f) of this section.

These contaminated media are P- and U-listed hazardous wastes and are subject to all RCRA requirements. Although contaminated soil, water or other debris are considered hazardous wastes under this listing, if they are decontaminated, they no longer meet the listing and therefore are not a listed hazardous waste nor do they "contain" a listed hazardous waste.

Both contaminated media which are themselves listed hazardous wastes (P- and U-listed wastes) and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Once a medium is decontaminated such that it no longer is a listed hazardous waste (P- and U-listed wastes) or no longer "contains" the listed hazardous waste, then Subtitle C ceases to apply.

Another way in which media may become "contaminated" is through contact with a characteristic hazardous waste (Step 2 on the decision matrix). If it can be validated that the medium was not contaminated by a characteristic hazardous waste, then the medium may be managed in accordance with best management practices. However, if knowledge of the originating waste stream indicates that contamination did result from a characteristic hazardous waste, or if the source of contamination is unknown, then the medium must be tested to determine whether it exhibits a hazardous waste characteristic (Step 3 on the decision matrix).

Any medium exhibiting a hazardous waste characteristic must be managed in accordance with Subtitle C regulations until it no longer exhibits the characteristic. If the medium is found not to exhibit a hazardous characteristic but is still "contaminated", it must be managed according to best management practices.

In summary, there are two key points to note when using the decision matrix. Contaminated media which are themselves hazardous wastes (P- and U-listed wastes), media which exhibit a hazardous waste characteristic, and media which "contain" listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices should be applied.

The management scenarios described above apply to a contaminated medium until such medium is decontaminated. Decontamination is required for all Appendix VIII constituents which are above health-based limits and background, not merely the Appendix VIII constituent for which the waste was listed or which caused the medium to exhibit a hazardous characteristic. All RCRA investigation and corrective action plans submitted to EPA Region IV for review and approval should include a sampling and analysis protocol for verifying that a medium has been decontaminated if treatment is to occur on-site. Sampling frequency for verifying decontamination will depend on a number of site-specific factors, such as the source of the contaminated medium, nature, extent and degree of contamination, and type of treatment. As an example, for small amounts of contaminated media (soil samples, drill cuttings, well purge water, etc.), testing of each drum or batch might provide adequate verification of decontamination. However, for large scale remediation of groundwater, periodic sampling might be appropriate. Chapter 9 of SW-846 provides more specific information regarding appropriate sampling procedures and frequencies.

A more detailed discussion of what "subject to Subtitle C regulations" means is provided in Section VI. Best management practices will be defined for each situation as part of the review process for sampling, investigation and corrective action plans. Some examples of best management practices are provided in Section V.B.

V. Management Procedures

This portion of the guidance contains several sub-sections which provide specific guidance for managing contaminated media under several common scenarios encountered at hazardous waste sites. This guidance provides the user with a high degree of flexibility to make site-specific management decisions. It also encourages the user to take full advantage of variances and exemptions provided for under RCRA.

A. RCRA Corrective Actions

Any contaminated medium containing a listed hazardous waste that is actively managed under a corrective action is subject to Subtitle C requirements. Any unit used for the treatment, storage, or disposal of such medium is also subject to Subtitle C requirements (see Section VI regarding applicability of Subtitle C requirements).

Any medium contaminated with a characteristic hazardous waste must be tested to determine if the medium exhibits any hazardous characteristics. If the medium does exhibit a hazardous characteristic, it is subject to Subtitle C requirements. Any unit used for the treatment, storage, or disposal of such medium is also subject to Subtitle C. A medium that does not exhibit a characteristic, or is treated such that it does not exhibit a characteristic, but is by definition contaminated, is subject to best management practices, but is not subject to Subtitle C requirements.

Treatment of a contaminated medium, whether it is from a listed or characteristic hazardous waste, may yield a decontaminated medium component and one or more waste components. The decontaminated medium component is not subject to RCRA Subtitle C, but may be subject to State and Local requirements, RCRA Subtitle D, and best management practices. The waste component is subject to RCRA Subtitle C requirements if it exhibits a hazardous waste characteristic or resulted from treatment of media containing a listed hazardous waste. Otherwise, disposal of the waste component is subject to State and Local requirements.

For corrective action purposes, a "no action" alternative should not be selected for a medium that is considered "contaminated", because that medium is still a health and environmental hazard until it is decontaminated.

B. Site Investigation Residues

If it has been determined that the environmental medium to be sampled is itself a hazardous waste (P- and U-listed wastes), exhibits a hazardous waste characteristic or "contains" a listed hazardous waste, then Subtitle C requirements apply to the residues (purge water, drill cuttings, drilling fluids, etc.) that are generated during the sampling event. These residues must be containerized and/or treated and disposed in a manner that is in compliance with Subtitle C of RCRA.

An issue of particular concern is the applicability of land disposal restrictions (LDRs) to site investigation residues. "Land disposal" occurs when hazardous wastes (or contaminated media subject to Subtitle C) are consolidated from different units into one unit, when media are moved outside the unit (for treatment or storage) and returned to the unit, or when media are excavated, placed in a separate waste mangement unit (such as an incinerator or tank within the unit), and redeposited in the unit.

The Agency has developed guidance which addresses the applicability of RCRA LDRs to contaminated residues generated during Superfund site investigations. The CERCLA Guide to Management of Investigation-Derived Waste (OSWER Directive 9345.3-03fs) states that storing investigation-derived waste (IDW) in containers within the Area of Contamination (AOC), and then returning it to its source does not trigger LDR treatment standards as long as the containers are not managed in a such a manner as to constitute a "hazardous waste management unit" as defined in 40 CFR §260.10. [4/] In addition, sampling and direct replacement of wastes within an AOC <u>do not</u> constitute land disposal. It must be emphasized that direct replacement of contaminated media can only occur <u>within an AOC</u>. Contaminated residue outside of the AOC should be containerized and/or treated and disposed in compliance with Subtitle C of RCRA.

The proposed RCRA 40 CFR Part 264 Subpart S rules contain provisions for a corrective action management unit (CAMU), the RCRA analog to the CERCLA AOC. In an August 1992 guidance entitled "Use of the Corrective Management Unit Concept", EPA provided clarification regarding use of the CAMU concept <u>prior</u> to finalization of the

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4/ An April 16, 1991, memorandum from Caroline H. Wehling, Attorney, Solid Waste and Emergency Response, to Steven C. Golian, Chief, Remedial Guidance Section, establishes that EPA does not generally consider drums placed within a landfill to form "container storage areas". Thus, if waste is placed into drums which remain in the AOC and which are not placed into a separate storage or treatment area, such placement would not be considered a unit distinct from the landfill itself.

Subpart S regulations. In this guidance, the Regions were advised that the CAMU concept may be used in some situations to allow designation of an area of broad contamination as a single unit for purposes of determining what RCRA management standards apply. Thus, if the CAMU concept can be used in accordance with the August 1992 guidance to the same extent that the Agency describes a Superfund AOC, then the OSWER Directive 9345.3-03FS interpretation of what constitutes land disposal can also be applied to RCRA site investigation residues.

When sampling in areas or zones of suspected contamination where documentation does not exist to confirm that the contamination source was a listed hazardous waste, residues should be containerized until test results are available to determine whether the residue exhibits a characteristic. If the medium does not exhibit a hazardous waste characteristic, then Subtitle C regulations do not apply but the environmental sampling residues should still be managed in a manner that is protective of human health and the environment (i.e., best management practices). Best management practices should be followed any time that test results indicate residues contain hazardous constituents above a health or environmental based limit (but the residues do not exhibit a hazardous characteristic and the contamination source was not a listed waste). Best management practices suggest that contaminated sampling residues be treated or disposed in a unit that is operated in accordance with an environmental permit (e.g., NPDES, UIC, RCRA, or State solid waste management). If treatment or disposal in a permitted unit at the facility is not an available option, then the residues may be sent to an approved off-site facility for treatment or disposal. Alternatively, the residues may be stored in a secure location at the facility until the waste site under investigation is remediated. The residues should then be included in the remediation process.

It is recommended that the amount of residues generated during a sampling event be minimized (e.g., if possible, conduct pump tests in areas outside the plume of contamination). Residues that are not expected to be contaminated should not be mixed with contaminated residues (e.g., drill cuttings removed from above the water table in an area with no surface soil contamination should not be mixed with cuttings removed from below the water table).

All sampling plans that are submitted to the Region IV RCRA program for review and approval should contain procedures that detail how residues will be managed in compliance with this guidance.

C. Hazardous Waste Spills

EPA has developed a straightforward approach for assessing the regulatory status of spilled hazardous wastes. The approach is based on the premise that "a spill of hazardous material to soil or groundwater is normally a simple act of disposal" (55 FR 22671), or, put more simply, a spill constitutes disposal.

Under this approach, the spill of a hazardous waste constitutes "unpermitted" disposal of hazardous waste. The Agency recognizes the need for prompt action in response to a spill, and has provided that cleanup need not be done under a RCRA permit, provided it is done expeditiously and in an environmentally sound manner (see 40 CFR §264.1(g)(8) and 40 CFR §265.1(c)(11)).

EPA regulations have been promulgated for certain "spill" scenarios, due to the nature of certain kinds of waste. 40 CFR §261.33(d) identifies how the cleanup residues from a spill of P- and U-listed chemical products must be managed. In summary, it says that the residue or contaminated debris (including soil and water) from the cleanup of a spill of P- or U-listed chemical product is a hazardous waste when discarded (or when intended to be discarded). The residues from spills of F- and K-listed wastes and characteristic wastes should be managed in accordance with the procedures set forth in Section IV of this document.

When a spilled material is recycled or able to be recycled, the RCRA recycling regulations may exempt it from any other hazardous waste regulations. But the difficulty of recycling spill residues in such matrices as soil and groundwater indicates that a simple assertion of intent to recycle is not sufficient to claim a recycling exemption from regulation. Therefore, EPA asserts that the burden of proof for recycling remains on the generator.

In 55 FR 22671, EPA identifies five objective considerations for the regulator to apply in reviewing a recycling assertion, namely:

1. whether the generator has begun to recycle the spill;
2. the length of time the spill residue has existed;
3. the value of the spilled material;
4. whether it is technically feasible or practical to recycle the spill; and
5. whether there is any history of the company recycling this type of spill residue.

Other considerations may apply in site-specific cases.

D. RCRA Closures

In closing a RCRA regulated land-based unit, a facility has two options: "clean closure" or leaving the waste and waste residues in place and conducting post-closure care. To clean close, a facility must remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate.

The regulations are not clear regarding management of contaminated subsoils or other environmental media that are removed to achieve clean closure. Specifically, the closure regulations do not distinguish between contaminated media, which is not a solid waste, and other contaminated materials, which could be solid waste. The regulations at 40 CFR §§265.197, 265.228, 265.258, 265.280 and 265.310 (and the corresponding permit standards in 40 CFR Part 264) all state that removed contaminated soils [5] must be managed as a hazardous waste unless 40 CFR §261.3(d) applies. 40 CFR §261.3(d), which provides for delisting and demonstration of absence of hazardous waste characteristic, only refers to solid waste. Although soils and groundwater are not solid waste, the Region extends the provision for the demonstration of absence of characteristic in 40 CFR §261.3(d) to environmental media.

This interpretation is valid in that it is not appropriate to apply more stringent standards to environmental media than to solid wastes. In addition, although a contaminated medium is not itself a solid waste, the contamination within the medium is a solid waste and 40 CFR §261.3(d) clearly applies. Therefore, contaminated media from RCRA closures must be managed as if they are hazardous wastes and must meet Subtitle C requirements as long as they contain a listed waste or exhibit a hazardous waste characteristic. If a medium does not exhibit a hazardous waste characteristic, best management practices apply.

The treatment of a contaminated medium may yield a decontaminated medium component and one or more waste components. The decontaminated medium component is not subject to RCRA Subtitle C. The waste component remains subject to Subtitle C unless and until 40 CFR §261.3(d) applies.

VI. Subtitle C Requirements

Sections IV and V of this guidance define "contaminated" media and establish which categories of contaminated media are subject to Subtitle C requirements. In summary, Subtitle C requirements apply to active management of any medium which is itself a hazardous waste (P- and U-listed waste), any medium which "contains" a listed hazardous waste, and any medium which exhibits a hazardous waste characteristic.

It is not possible for one guidance to examine all of the Subtitle C requirements which might apply to management of contaminated media.

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[5] As clarified in 52 FR 8705, the Agency interprets the term "soil" broadly to include both unsaturated soils and soils containing groundwater. Uncontaminated groundwater is therefore a requirement for clean closure.

However, once the determination is made that the contaminated medium is subject to Subtitle C requirements, then the applicable Subtitle C requirements are the same as if that medium were in fact a hazardous waste. Thus, it is necessary to consider how the medium is being managed in determining which Subtitle C requirements would apply.

One of the most commonly asked questions is whether management of contaminated media requires a permit, especially if a contaminated medium is being managed as a result of corrective action under RCRA §3004(u), §3004(v) and §3008(h). To address this question, Region IV conducted a legal analysis of the RCRA regulations and corrective action legislative history. In summary, if the source of contamination renders media "subject to Subtitle C requirements" as explained in this guidance, and if the conduct of corrective action under RCRA §3004(u), §3004(v) or §3008(h) includes a storage, treatment or disposal activity that ordinarily requires a permit, such permit [6/] must be obtained. While this requirement will undoubtedly retard the corrective action process, it is inescapable absent rulemaking relief.

It is important to remember that RCRA Subtitle C standards include a number of waivers and conditional exemptions which can be applied to contaminated media (just as they are applied to hazardous waste). For example, if air stripping of contaminated groundwater occurs in a wastewater treatment unit subject to §402 or §307(b) of the Clean Water Act, and the unit also meets the RCRA definition of a tank or tank system, the treatment would not require a RCRA permit (40 CFR §264.1(g)(6)). Furthermore, the air stripping operation would not be subject to the Subpart AA air emission standards standards [7/] (55 FR 25456). As another example, 40 CFR §261.4(b)(10) exempts from the definition of hazardous waste petroleum-contaminated media and debris that fail the test for Toxicity Characteristic and are subject to corrective action regulations under 40 CFR Part 280. The user of this guidance is encouraged to take full advantage of these and all other RCRA waivers and exemptions to expedite corrective action.

VII. Decision Matrix for Management of Contaminated Media

A decision matrix has been provided to assist the user in making the correct regulatory decision for management of contaminated media. There are two key points to note when using the decision matrix. Contaminated

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6/ Depending on whether the facility already has permit or has interim status, a permit modification under 40 CFR §270.41 or 40 CFR §270.42, or change in interim status under 40 CFR §270.72 would be appropriate.

7/ Nevertheless, corrective action authorities should be used to ensure that the air emissions will not pose a threat to human health and the environment.

media which are themselves hazardous wastes (P- and U-listed wastes), and media which exhibit a hazardous waste characteristic or which "contain" a listed hazardous waste must be managed in accordance with Subtitle C regulations. Where documentation does not exist to confirm that the contamination source (or the medium of interest, in the case of P- and U-listed wastes) is a listed waste and the medium does not exhibit a hazardous waste characteristic, best management practices may be applied.

VIII. Relation to CERCLA Activities

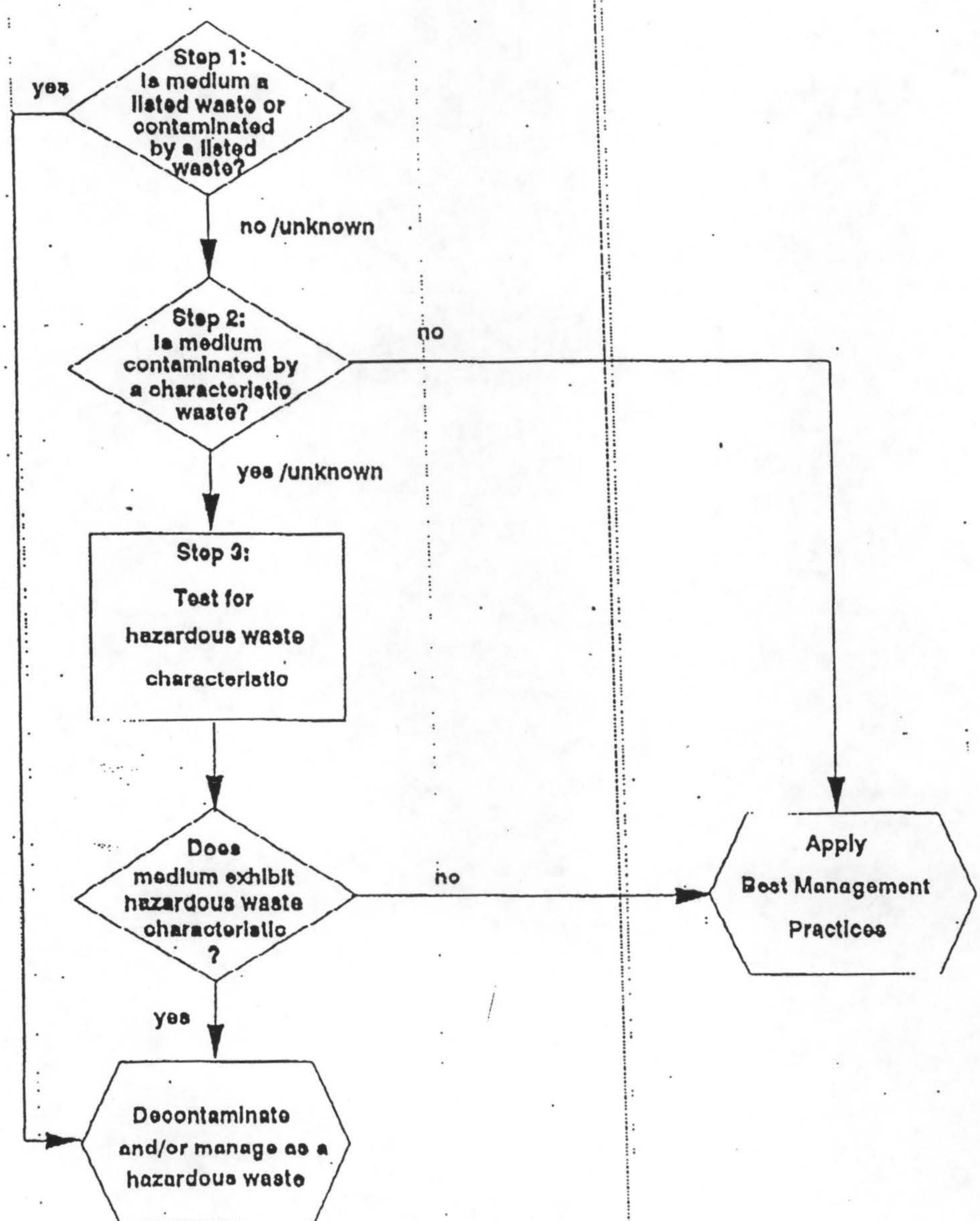
Contaminated environmental media may be generated or actively managed during CERCLA investigations, remedial actions and response actions. The National Contingency Plan (NCP) requires that for all remedial actions, the selected remedy must attain or exceed the applicable or relevant and appropriate requirements (ARARs) in environmental laws. It also requires removal actions to attain ARARs to the greatest extent practicable, considering the exigencies of the circumstances. This guidance is an interpretation of RCRA regulations and as such should be considered in evaluating ARARs for CERCLA activities.

When implementing this guidance into CERCLA activities, the user is encouraged to take full advantage of all waivers and exemptions provided under either RCRA or CERCLA. For example, CERCLA section 121(e) establishes that a RCRA permit is not required for any CERCLA removal and remedial actions conducted entirely on-site at NPL sites. OSWER Policy Directive #9522.00-2 extends this permit waiver authority to uncontrolled sites 8/ if the state has adopted equivalent language to CERCLA section 121(e).

In summary, this guidance represents an interpretation of RCRA regulations, directives and policy. Incorporation of this guidance into CERCLA activities should be evaluated similarly to any other RCRA ARAR.

8/ "Uncontrolled sites" are those hazardous waste sites which are being handled by the State's equivalent to the Superfund program.

DECISION MATRIX FOR MANAGING CONTAMINATED MEDIA



APPENDIX B

USEPA RISK-BASED CONCENTRATIONS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Street
Philadelphia, Pennsylvania 19107

October 22, 1997

SUBJECT: Risk-Based Concentration Table

FROM: Eric W. Johnson, Chief
Technical Support Section (3HW41)

TO: RBC Table Recipients

Attached is the EPA Region III Risk-Based Concentration (RBC) table, which we distribute periodically to all interested parties.

IMPORTANT MESSAGE

EPA Region III's Internet website now includes the RBC Table as a readable file for on-screen use and as "zipped" files, in Lotus and Excel. These can be found at **http://www.epa.gov/reg3hwmd/riskmenu.htm**. *(Once there, I suggest you set a bookmark to ease future access.) The cover memo and background information are also included in both formats.*

We encourage all RBC Table users with Internet access to obtain the table electronically rather than on paper. In this way, users can access the most current RBC table immediately in a form that can be used directly for comparisons with data or risk estimates. This distribution method also saves hundreds of pounds of paper per year and costs substantially less.

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The Table contains reference doses and carcinogenic potency slopes (obtained from IRIS through September 1, 1997, HEAST through July 1997, the EPA-NCEA Superfund Health Risk Technical Support Center, and other EPA sources) for about 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (*i.e.*, a hazard quotient of one, or lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The RBC table formerly included soil screening levels (SSLs) for protection of groundwater and air. We have discontinued these to avoid conflicts with EPA/OSWER's SSL guidance document, now in general use. To consider intermedia transfers of contaminants at the screening stage of risk assessment, we suggest that you use this guidance (available from NTIS as document numbers 9355.4-1, PB95-965530, or EPA540/R-94/105).

The Region III toxicologists use RBCs to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The background materials provide the complete basis for all the calculations, with the intent of showing users exactly how the RBCs were developed. Simply put, RBCs are risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air and groundwater, and (2) cumulative risk from multiple contaminants or media. Also, the toxicity information in the table has been assembled by hand, and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CPSs in the table. If you find any errors, please send me a note.

Many users want to know if the risk-based concentrations can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that the RBC table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all of the health risk;

3. Volatilization or leaching of that contaminant from soil is expected not to be significant;

4. The exposure scenarios used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is expected not to be significant;

the risk-based concentrations would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the table should generally not be used to (1) set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, (2) substitute for EPA guidance for preparing baseline risk assessments, or (3) determine if a waste is hazardous under RCRA.

ANSWERS TO FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than the inhalation rate for either a child (12) or an adult (20)?

Age-adjusted factors are not intake rates, but rather partial calculations which have different units than intake rates do. The fact that these partial calculations have values similar to intake rates is really coincidental, an artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. Why does arsenic appear in the RBC table separately as a carcinogen and a non-carcinogen, while other contaminants do not?

Arsenic is double-entered to ensure that the risk assessor realizes that non-carcinogenic concerns are significant for arsenic. Otherwise, it might be tempting to accept a 1e-4 risk (43 ppm in residential soil), when the oral reference dose would be exceeded at 23 ppm.

Also, EPA has a little-known risk management policy for arsenic (dating from 1988) that suggests that arsenic-related cancer risks of up to 1e-3 can be accepted because the cancers are squamous cell carcinomas with a low mortality rate. Thus, non-carcinogenic RBCs represent an important limitation on acceptable arsenic concentrations.

3. Many contaminants have no inhaled reference dose or carcinogenic potency slope in IRIS, yet these numbers appear in the RBC table with IRIS given as the source. Where did the numbers come from?

Most inhaled reference doses and potency slopes in the RBC table are converted from reference concentrations and unit risk values which do appear in IRIS. These conversions assume 70-kg persons inhaling 20 m^3/d. For example, the inhalation unit risk for arsenic (4.3e-3 risk per $\mu g/m^3$) is divided by 20 m^3/d and multiplied by 70 kg times 1000 μg/mg, yielding a CPSi of 15.1 risk per mg/kg/d.

4. Why does the RBC table base soil RBCs for cadmium on a reference dose that applies only to drinking water?

The RBC table's use of the drinking water RfDs for cadmium reflects (1) the limited space available in the already-crowded table, and (2) the intended use of the table as a screening tool rather than a source of cleanup levels (thereby making false positives acceptable). For a formal risk assessment, Region III would use the food RfD for soil ingestion.

At this time, only cadmium(as far as we know) has distinct oral RfDs for water and food. Adding the food RfD to the table would require an entire column, which would be about 99.9% blank. The table has become so crowded that it would be difficult to accommodate another column. Also, we've given this problem a relatively low priority because the table's primary purpose is to identify environmental problems needing further study. RBCs were never intended for uncritical use as cleanup levels, merely to identify potential problems which need a closer look.

5. For manganese, IRIS shows an oral reference dose of 0.14 mg/kg/d, but the RBC table uses 2.3e-2 mg/kg/d. Why? The IRIS RfD includes manganese from all sources, including diet. The explanatory text in IRIS recommends using a modifying factor of 3 when calculating risks associated with ingesting soil or drinking water, and the table follows this recommendation. I have also incorporated a factor of 2 for relative source contribution on the assumption that a typical individual will obtain half of the RfD (5 mg/d, or 0.07 mg/kg/d) from her diet, thereby limiting the acceptable contribution from soil and water to only half of the IRIS RfD. Thus, the IRIS RfD has been lowered by a factor of 2x3, or 6.

7. What is the source of the child's inhalation rate of 12 m3/d?

The calculation comes from basic physiology. It's a scaling of the mass-specific 20 m3/d rate for adults from a body mass of 70 kg to 15 kg, using the two-thirds power of mass, as follows:

Let:	IRcm	=	mass-specific child inhalation rate (m3/kg/d)
	IRc	=	child inhalation rate (m3/d)

20 m3/d ÷ 70kg = 0.286 m3/kg/d (mass-specific adult inhalation rate)

0.286 m3/kg/d x $(70^{.67})$ = (IRcm) x $(15^{.67})$

IRcm = (0.286) x $(70^{.67})$ ÷ $(15^{.67})$ = 0.286 x 2.807 = 0.803 m3/kg/d

IRc = IRcm x 15kg = 0.803 m3/kg/d x 15kg = 12.04 m3/d

A short (but algebraically equivalent) way to do the conversion:

20 x $(15 \div 70)^{.333}$ = 11.97 (different from, but actually more correct than, 12.04 because of rounding error in calculating by the long form).

8. Can the oral RfDs in the RBC table be applied to dermal exposure?

Not directly. EPA's Office of Research and Development is working on dermal RfDs for some substances, but has not yet produced any final values. When dermal RfDs do appear, they will undoubtedly be based on absorbed dose rather than administered dose. Oral RfDs are (usually) based on administered dose and therefore tacitly include a GI absorption factor. Thus, any use of oral RfDs in dermal risk calculations would have to involve removing this absorption factor. Consult the Risk Assessment Guidance for Superfund, Part A, Appendix A, for further details on how to do this.

*9. The exposure variables table in the RBC background document lists the averaging time for non-carcinogens as "ED*365". What does that mean?*

ED is exposure duration, in years, and '*' is the computer-ese symbol for multiplication. Multiplying ED by 365 simply converts the duration to days. In fact, the ED term is included in both the numerator and denominator of the RBC algorithms for non-cancer risk, canceling it altogether. We expressed the algorithm this way to allow users to realize this. The total exposure is really adjusted only by EF (days exposed per year) divided by 365. (Note that this explanation applies to non-carcinogenic risk only; for carcinogens, exposure is pro-rated over the number of days in a 70-year life span.)

10. Why is inorganic lead not included in the RBC table?

The reason that lead is missing from the RBC table is simple, and fundamental: EPA has no reference dose or potency slope for inorganic lead, so it wasn't possible to calculate risk-based concentrations. EPA considers lead a special case because:

(1) Lead is ubiquitous in all media, so human exposure comes from multiple sources. Comparing single-medium exposures with a reference dose would be misleading.

(2) If EPA did develop a reference dose for lead by the same methods other reference doses, we would probably find that most people already exceed it. Since EPA already knows this and is moving aggressively to lower lead releases nationally, such findings at individual sites would be irrelevant and unduly alarming.

(3) EPA decided to take a new approach to distinguish important lead exposures from trivial ones. EPA developed a computer model (the IEUBK model) which predicts children's blood lead concentrations using lead levels in various media as inputs. The idea is to evaluate a child's entire environment, and reduce lead exposures in the most cost-effective way.

On the practical side, there are several EPA policies on lead which effectively substitute for RBCs. The EPA Office of Solid Waste has released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 ppm be considered safe for residential use. Above that level, the document suggests collecting certain types of data and modeling children's blood lead with the IEUBK model. For the purposes of the RBC table, the *de facto* residential soil number would be 400 mg/kg. For water, we suggest 15 ppb (from the national EPA Action Level), and for air, the National Ambient Air Quality Standard.

11. Where did the potency slopes for carcinogenic PAHs come from?

The source of the potency slopes for PAHs is "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," Final Draft, EPA Environmental Criteria and Assessment Office, Cincinnati, OH. It's available from NTIS as document number ECAO-CIN-842 (March, 1993). The slopes are expressed in terms of order-of-magnitude equivalence factors relating the compounds to benzo[a]pyrene; we have converted these TEQs to potency slopes to fit the format of the table.

12. May I please have a copy of the January 1991 RBC table?

We're sorry, but no. The RBC table doesn't represent regulation or guidance, so past issues have no legal importance. Each time we update the table we destroy all obsolete copies, electronic and paper. We do this to ensure that only one set of RBCs, the one based on current information, exists at any time.

13. I've noticed that some soil RBCs are one million parts per million. Since some of these substances are liquids, that's obviously ridiculous. What is that basis for these calculations?

A soil RBC of one million parts per million means that no amount of the contaminant in soil will cause a receptor to exceed the oral reference dose by incidental ingestion of soil. In fact, some contaminants would have RBCs of more than one million ppm, but the algorithms cap concentrations at 100%. The reason we retain these admittedly impossible numbers is to let users see that the contaminant is not a threat via soil ingestion.

However, it's important to realize that the RBC calculations do not consider the potential of soil contaminants to leach to groundwater or escape to air by volatilization or dust entrainment. To consider these inter-media transfers, it's necessary to either monitor air and groundwater, or to use a mathematical model. Measured or modeled air and groundwater concentrations should then be compared to the RBCs for air and tap water.

Inter-media transfers are considered more fully in the soil screening level (SSL) guidance. The SSL guidance also incorporates sampling recommendations and statistical application of the SSLs. However, EPA Headquarters has proposed only about a hundred SSLs so far, so the list is still rather short.

14. Please elaborate on the meaning of the 'W' source code in the table.

The "W" code means that a reference dose or potency slope for a contaminant is currently not present on either IRIS or HEAST, but that it once was present on either IRIS or HEAST and was removed. Such withdrawal usually indicates that consensus on the number no longer exists among EPA scientists, but not that EPA believes the contaminant to be unimportant. Older versions of the RBC table had separate codes for IRIS and HEAST withdrawals, but we changed to a single code for both because, after all, it hardly matters.

We retain withdrawn numbers in the table because we still need to deal with these contaminants during the sometimes very long delays before replacement numbers are ready. We take the position that for the purpose of screening an obsolete RBC is better than none at all. The 'W' code should serve as a clear warning that before making any serious decision involving that contaminant you will need to develop an interim value based on current scientific understanding.

If you are assessing risks at a site where a major contaminant is coded "W," consider working with your Regional EPA risk assessor to develop a current toxicity constant. If the site is being studied under CERCLA, the EPA-NCEA Regional Technical Support group may be able to assist.

15. Can I get copies of supporting documents for interim toxicity constants which are coded "E" in the RBC table?

Unfortunately, Region 3 does not have a complete set of supporting documents. The EPA-NCEA Superfund Health Risk Technical Support Center prepares these interim toxicity constants in response to site-specific requests from Regional risk assessors, and sends the documentation only to the requestor. The RBC tables contain only the interim values (those with "E" codes) that we've either requested ourselves or otherwise obtained copies of. There may be many more interim values of which we are unaware. Also, we don't receive automatic updates when NCEA revisits a contaminant, so it's likely that some interim values in the RBC table are obsolete.

It has been NCEA's policy to deny requests for documentation of interim toxicity constants when the documentation is more than two years old. Furthermore, since NCEA's Superfund Technical Support Center is mainly for the support of Superfund, it usually cannot develop new toxicity criteria unless authorized to do so for a specific Superfund project. Although Region 3 has sometimes provided documentation to support numbers we use in risk assessments, for the above-stated reasons we have no assurance that the assessments, or even the interim numbers, are current. We've decided to discontinue distributing information that may be misleading. If an "E"-coded contaminant is a major risk contributor at your site, we strongly suggest that you work with EPA to develop an up-to-date reference dose or slope factor.

CHANGES IN THIS ISSUE OF THE RBC TABLE

Substances having new or revised EPA toxicity constants that result in a change in a revised RBC are now flagged marked with "**" before the contaminant name. This is to help users quickly pick out substances with new RBCs.

QUESTIONS, COMMENTS AND ADVICE

If you have a question about the RBC Table, please call EPA Region III's Superfund Technical Support Section at 215-566-3041. We'll do our best to answer your questions about how the Table was prepared and what the numbers mean. If you have a question about applying the RBC Table to a specific site, please contact the EPA Regional Office handling the project. Thanks for your help and cooperation, and we hope that the RBC Table continues to be a useful resource.

Attachment

Risk-Based Concentration Table
October 22, 1997

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST
E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis : C=carcinogenic effects
N=non-carcinogenic effects

Contaminant	CAS	RfDo mg/kg/d		RfDi mg/kg/d		CPSo kg·d/mg		CPSi kg·d/mg		VOC	Risk-Based Concentrations: Tap Water µg/L		Ambient Air µg/m3		Fish mg/kg		Soil Ingestion: Industrial mg/kg		Residential mg/kg	
Acephate	30560191	4.00E-03	I			8.70E-03	I				7.70E+00	C	7.20E-01	C	3.60E-01	C	6.60E+02	C	7.30E+01	C
Acetaldehyde	75070			2.57E-03	I			7.70E-03	I		9.40E+01	N	8.10E-01	C	0.00E+00		0.00E+00		0.00E+00	
Acetochlor	34256821	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Acetone	67641	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
**Acetone cyanohydrin	75865	8.00E-04	H	2.86E-03	A						2.90E+01	N	1.00E+01	N	1.10E+00	N	1.60E+03	N	6.30E+01	N
Acetonitrile	75078	6.00E-03	I	1.43E-02	A						2.20E+02	N	5.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N
Acetophenone	98862	1.00E-01	I	5.71E-06	W					x	4.20E-02	N	2.10E-02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Acifluorfen	62476599	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Acrolein	107028	2.00E-02	H	5.71E-06	I						7.30E+02	N	2.10E-02	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Acrylamide	79061	2.00E-04	I			4.50E+00	I	4.55E+00	I		1.50E-02	C	1.40E-03	C	7.00E-04	C	1.30E+00	C	1.40E-01	C
Acrylic acid	79107	5.00E-01	I	2.86E-04	I						1.80E+04	N	1.00E+00	N	6.80E+02	N	1.00E+06	N	3.90E+04	N
Acrylonitrile	107131	1.00E-03	H	5.71E-04	I	5.40E-01	I	2.38E-01	I		1.20E-01	C	2.60E-02	C	5.80E-03	C	1.10E+01	C	1.20E+00	C
Alachlor	15972608	1.00E-02	I			8.00E-02	H				8.40E-01	C	7.80E-02	C	3.90E-02	C	7.20E+01	C	8.00E+00	C
Alar	1596845	1.50E-01	I								5.50E+03	N	5.50E+02	N	2.00E+02	N	3.10E+05	N	1.20E+04	N
Aldicarb	116063	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Aldicarb sulfone	1646884	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Aldrin	309002	3.00E-05	I			1.70E+01	I	1.71E+01	I		4.00E-03	C	3.70E-04	C	1.90E-04	C	3.40E-01	C	3.80E-02	C
Ally	74223646	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N
Allyl alcohol	107186	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Allyl chloride	107051	5.00E-02	W	2.86E-04	I						1.80E+03	N	1.00E+00	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
**Aluminum	7429905	1.00E+00	E	1.00E-03	E						3.70E+04	N	3.70E+00	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Aluminum phosphide	20859738	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Amdro	67485294	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Ametryn	834128	9.00E-03	I								3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N
**Aminodinitrotoluenes	0	6.00E-05	E								2.20E+00	N	2.20E-01	N	8.10E-02	N	1.20E+02	N	4.70E+00	N
m-Aminophenol	591275	7.00E-02	H								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
4-Aminopyridine	504245	2.00E-05	H								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N
Amitraz	33089611	2.50E-03	I								9.10E+01	N	9.10E+00	N	3.40E+00	N	5.10E+03	N	2.00E+02	N
Ammonia	7664417			2.86E-02	I						1.00E+03	N	1.00E+02	N	0.00E+00		0.00E+00		0.00E+00	
Ammonium sulfamate	7773060	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Aniline	62533			2.86E-04	I	5.70E-03	I				1.00E+01	N	1.00E+00	N	5.50E-01	C	1.00E+03	C	1.10E+02	C
Antimony and compounds	7440360	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Antimony pentoxide	1314609	5.00E-04	H								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N
Antimony potassium tartrate	304610	9.00E-04	H								3.30E+01	N	3.30E+00	N	1.20E+00	N	1.80E+03	N	7.00E+01	N
Antimony tetroxide	1332316	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
**Antimony trioxide	1309644	4.00E-04	H	5.71E-05	I						1.50E+01	N	2.10E-01	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Apollo	74115245	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Aramite	140578	5.00E-02	H			2.50E-02	I	2.49E-02	I		2.70E+00	C	2.50E-01	C	1.30E-01	C	2.30E+02	C	2.60E+01	C
Arsenic	7440382	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Arsenic (as carcinogen)	7440382					1.50E+00	I	1.51E+01	I		4.50E-02	C	4.10E-04	C	2.10E-03	C	3.80E+00	C	4.30E-01	C
Arsine	7784421			1.43E-05	I						5.20E-01	N	5.20E-02	N	0.00E+00		0.00E+00		0.00E+00	

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											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Assure	76578148	9.00E-03	I								3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N
Asulam	3337711	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Atrazine	1912249	3.50E-02	I			2.22E-01	H				3.00E-01	C	2.80E-02	C	1.40E-02	C	2.60E+01	C	2.90E+00	C
Avermectin B1	65195553	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Azobenzene	103333					1.10E-01	I	1.08E-01	I		6.10E-01	C	5.80E-02	C	2.90E-02	C	5.20E+01	C	5.80E+00	C
Barium and compounds	7440393	7.00E-02	I	1.43E-04	A						2.60E+03	N	5.20E-01	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
Baygon	114261	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Bayleton	43121433	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Baythroid	68359375	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Benefin	1861401	3.00E-01	I								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Benomyl	17804352	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Bentazon	25057890	2.50E-03	I								9.10E+01	N	9.10E+00	N	3.40E+00	N	5.10E+03	N	2.00E+02	N
Benzaldehyde	100527	1.00E-01	I							x	6.10E+02	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Benzene	71432	3.00E-03	E	1.71E-03	E	2.90E-02	I	2.90E-02	I	x	3.60E-01	C	2.20E-01	C	1.10E-01	C	2.00E+02	C	2.20E+01	C
Benzenethiol	108985	1.00E-05	H								3.70E-01	N	3.70E-02	N	1.40E-02	N	2.00E+01	N	7.80E-01	N
Benzidine	92875	3.00E-03	I			2.30E+02	I	2.35E+02	I		2.90E-04	C	2.70E-05	C	1.40E-05	C	2.50E-02	C	2.80E-03	C
Benzoic acid	65850	4.00E+00	I								1.50E+05	N	1.50E+04	N	5.40E+03	N	1.00E+06	N	3.10E+05	N
Benzotrichloride	98077					1.30E+01	I				5.20E-03	C	4.80E-04	C	2.40E-04	C	4.40E-01	C	4.90E-02	C
Benzyl alcohol	100516	3.00E-01	H								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Benzyl chloride	100447					1.70E-01	I			x	6.20E-02	C	3.70E-02	C	1.90E-02	C	3.40E+01	C	3.80E+00	C
Beryllium and compounds	7440417	5.00E-03	I			4.30E+00	I	8.40E+00	I		1.60E-02	C	7.50E-04	C	7.30E-04	C	1.30E+00	C	1.50E-01	C
Bidrin	141662	1.00E-04	I								3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N
Biphenthrin (Talstar)	82657043	1.50E-02	I								5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N
1,1-Biphenyl	92524	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Bis(2-chloroethyl)ether	111444					1.10E+00	I	1.16E+00	I	x	9.20E-03	C	5.40E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C
Bis(2-chloroisopropyl)ether	39638329	4.00E-02	I			7.00E-02	W	3.50E-02	W	x	2.60E-01	C	1.80E-01	C	4.50E-02	C	8.20E+01	C	9.10E+00	C
Bis(chloromethyl)ether	542881					2.20E+02	I	2.17E+02	I	x	4.90E-05	C	2.90E-05	C	1.40E-05	C	2.60E-02	C	2.90E-03	C
**Bis(2-chloro-1-methylethyl)ether	0					7.00E-02	H	3.50E-02	H		9.60E-01	C	1.80E-01	C	4.50E-02	C	8.20E+01	C	9.10E+00	C
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02	I			1.40E-02	I	1.40E-02	E		4.80E+00	C	4.50E-01	C	2.30E-01	C	4.10E+02	C	4.60E+01	C
Bisphenol A	80057	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Boron (and borates)	7440428	9.00E-02	I	5.71E-03	H						3.30E+03	N	2.10E+01	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
Boron trifluoride	7637072			2.00E-04	H						7.30E+00	N	7.30E-01	N	0.00E+00		0.00E+00		0.00E+00	
Bromodichloromethane	75274	2.00E-02	I			6.20E-02	I			x	1.70E-01	C	1.00E-01	C	5.10E-02	C	9.20E+01	C	1.00E+01	C
Bromoethene	593602							1.10E-01	H	x	9.60E-02	C	5.70E-02	C	0.00E+00		0.00E+00		0.00E+00	
Bromoform (tribromomethane)	75252	2.00E-02	I			7.90E-03	I	3.85E-03	I	x	2.40E+00	C	1.60E+00	C	4.00E-01	C	7.20E+02	C	8.10E+01	C
Bromomethane	74839	1.40E-03	I	1.43E-03	I					x	8.70E+00	N	5.20E+00	N	1.90E+00	N	2.90E+03	N	1.10E+02	N
4-Bromophenyl phenyl ether	101553	5.80E-02	O								2.10E+03	N	2.10E+02	N	7.80E+01	N	1.20E+05	N	4.50E+03	N
Bromophos	2104963	5.00E-03	H								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Bromoxynil	1689845	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Bromoxynil octanoate	1689992	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1,3-Butadiene	106990							9.80E-01	I	x	1.10E-02	C	6.40E-03	C	0.00E+00		0.00E+00		0.00E+00	

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											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
1-Butanol	71363	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Butyl benzyl phthalate	85687	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Butylate	2008415	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
**n-Butylbenzene	104518	1.00E-02	E							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
sec-Butylbenzene	135988	1.00E-02	E							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
tert-Butylbenzene	104518	1.00E-02	E							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Butylphthalyl butylglycolate	85701	1.00E+00	I								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Cacodylic acid	75605	3.00E-03	H								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Cadmium and compounds	7440439	5.00E-04	I	5.71E-05	W			6.30E+00	I		1.80E+01	N	9.90E-04	C	6.80E-01	N	1.00E+03	N	3.90E+01	N
Caprolactam	105602	5.00E-01	I								1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N	3.90E+04	N
Captafol	2425061	2.00E-03	I			8.60E-03	H				7.80E+00	C	7.30E-01	C	3.70E-01	C	6.70E+02	C	7.40E+01	C
Captan	133062	1.30E-01	I			3.50E-03	H				1.90E+01	C	1.80E+00	C	9.00E-01	C	1.60E+03	C	1.80E+02	C
Carbaryl	63252	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Carbofuran	1563662	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Carbon disulfide	75150	1.00E-01	I	2.00E-01	I					x	1.00E+03	N	7.30E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Carbon tetrachloride	56235	7.00E-04	I	5.71E-04	E	1.30E-01	I	5.25E-02	I	x	1.60E-01	C	1.20E-01	C	2.40E-02	C	4.40E+01	C	4.90E+00	C
Carbosulfan	55285148	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Carboxin	5234684	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Chloral	75876	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Chloramben	133904	1.50E-02	I								5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N
Chloranil	118752					4.03E-01	H				1.70E-01	C	1.60E-02	C	7.80E-03	C	1.40E+01	C	1.60E+00	C
**Chlordane	57749	5.00E-04	I			3.50E-01	I	3.50E-01	I		1.90E-01	C	1.80E-02	C	9.00E-03	C	1.60E+01	C	1.80E+00	C
Chlorimuron-ethyl	90982324	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Chlorine	7782505	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Chlorine dioxide	10049044			5.71E-05	I						2.10E+00	N	2.10E-01	N	0.00E+00		0.00E+00		0.00E+00	
Chloroacetaldehyde	107200	6.90E-03	O								2.50E+02	N	2.50E+01	N	9.30E+00	N	1.40E+04	N	5.40E+02	N
Chloroacetic acid	79118	2.00E-03	H								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
2-Chloroacetophenone	532274			8.57E-06	I						3.10E-01	N	3.10E-02	N	0.00E+00		0.00E+00		0.00E+00	
4-Chloroaniline	106478	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Chlorobenzene	108907	2.00E-02	I	5.71E-03	A					x	3.90E+01	N	2.10E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Chlorobenzilate	510156	2.00E-02	I			2.70E-01	H	2.70E-01	H		2.50E-01	C	2.30E-02	C	1.20E-02	C	2.10E+01	C	2.40E+00	C
p-Chlorobenzoic acid	74113	2.00E-01	H								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
4-Chlorobenzotrifluoride	98566	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
2-Chloro-1,3-butadiene (chloroprene)	126998	2.00E-02	A	2.00E-03	H					x	1.40E+01	N	7.30E+00	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1-Chlorobutane	109693	4.00E-01	H							x	2.40E+03	N	1.50E+03	N	5.40E+02	N	8.20E+05	N	3.10E+04	N
Chlorodibromomethane	124481	2.00E-02	I			8.40E-02	I			x	1.30E-01	C	7.50E-02	C	3.80E-02	C	6.80E+01	C	7.60E+00	C
1-Chloro-1,1-difluoroethane	75683			1.43E+01	I					x	8.70E+04	N	5.20E+04	N	0.00E+00		0.00E+00		0.00E+00	
Chlorodifluoromethane	75456			1.43E+01	I					x	8.70E+04	N	5.20E+04	N	0.00E+00		0.00E+00		0.00E+00	
**Chloroethane	75003	4.00E-01	E	2.86E+00	I	2.90E-03	E			x	3.60E+00	C	2.20E+00	C	1.10E+00	C	2.00E+03	C	2.20E+02	C
2-Chloroethyl vinyl ether	110758	2.50E-02	O							x	1.50E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Chloroform	67663	1.00E-02	I			6.10E-03	I	8.05E-02	I	x	1.50E-01	C	7.80E-02	C	5.20E-01	C	9.40E+02	C	1.00E+02	C

Risk-Based Concentration Table
October 22, 1997

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											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	**CAS**	**mg/kg/d**		**mg/kg/d**		**kg·d/mg**		**kg·d/mg**		**C**	**µg/L**		**µg/m3**		**mg/kg**		**mg/kg**		**mg/kg**	
Chloromethane	74873					1.30E-02	H	6.30E-03	H	x	1.40E+00	C	9.90E-01	C	2.40E-01	C	4.40E+02	C	4.90E+01	C
4-Chloro-2-methylaniline hydrochloride	3165933					4.60E-01	H				1.50E-01	C	1.40E-02	C	6.90E-03	C	1.20E+01	C	1.40E+00	C
4-Chloro-2-methylaniline	95692					5.80E-01	H				1.20E-01	C	1.10E-02	C	5.40E-03	C	9.90E+00	C	1.10E+00	C
beta-Chloronaphthalene	91587	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
o-Chloronitrobenzene	88733					2.50E-02	H			x	4.20E-01	C	2.50E-01	C	1.30E-01	C	2.30E+02	C	2.60E+01	C
p-Chloronitrobenzene	100005					1.80E-02	H			x	5.90E-01	C	3.50E-01	C	1.80E-01	C	3.20E+02	C	3.50E+01	C
2-Chlorophenol	95578	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
2-Chloropropane	75296			2.86E-02	H					x	1.70E+02	N	1.00E+02	N	0.00E+00		0.00E+00		0.00E+00	
Chlorothalonil	1897456	1.50E-02	I			1.10E-02	H				6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C	5.80E+01	C
o-Chlorotoluene	95498	2.00E-02	I							x	1.20E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Chlorpropham	101213	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Chlorpyrifos	2921882	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Chlorpyrifos-methyl	5598130	1.00E-02	H								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Chlorsulfuron	64902723	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Chlorthiophos	60238564	8.00E-04	H								2.90E+01	N	2.90E+00	N	1.10E+00	N	1.60E+03	N	6.30E+01	N
Chromium III and compounds	16065831	1.00E+00	I	5.71E-07	W						3.70E+04	N	2.10E-03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Chromium VI and compounds	18540299	5.00E-03	I					4.20E+01	I		1.80E+02	N	1.50E-04	C	6.80E+00	N	1.00E+04	N	3.90E+02	N
Coal tar	8001589							2.20E+00	W		0.00E+00		2.80E-03	C	0.00E+00		0.00E+00		0.00E+00	
Cobalt	7440484	6.00E-02	E								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
Coke Oven Emissions	8007452							2.17E+00	I		0.00E+00		2.90E-03	C	0.00E+00		0.00E+00		0.00E+00	
**Copper and compounds	7440508	3.50E+00	H								1.30E+05	N	1.30E+04	N	4.70E+03	N	1.00E+06	N	2.70E+05	N
Crotonaldehyde	123739	1.00E-02	W			1.90E+00	H	1.90E+00	W		3.50E-02	C	3.30E-03	C	1.70E-03	C	3.00E+00	C	3.40E-01	C
**Cumene	98828	1.00E-01	I	1.14E-01	I						3.70E+03	N	4.20E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Cyanides:	0										0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Barium cyanide	542621	1.00E-01	W								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Calcium cyanide	592018	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Chlorine cyanide	506774	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Copper cyanide	544923	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Cyanazine	21725462	2.00E-03	H			8.40E-01	H				8.00E-02	C	7.50E-03	C	3.80E-03	C	6.80E+00	C	7.60E-01	C
Cyanogen	460195	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Cyanogen bromide	506683	9.00E-02	I								3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
Cyanogen chloride	506774	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Free cyanide	57125	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Hydrogen cyanide	74908	2.00E-02	I	8.57E-04	I						7.30E+02	N	3.10E+00	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Potassium cyanide	151508	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Potassium silver cyanide	506616	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Silver cyanide	506649	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Sodium cyanide	143339	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
**Thiocyanate	0	1.00E-01	E								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Zinc cyanide	557211	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Cyclohexanone	108941	5.00E+00	I							x	3.00E+04	N	1.80E+04	N	6.80E+03	N	1.00E+06	N	3.90E+05	N

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										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Cyclohexlamine	108918	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Cyhalothrin/Karate	68085858	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Cypermethrin	52315078	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Cyromazine	66215278	7.50E-03	I								2.70E+02	N	2.70E+01	N	1.00E+01	N	1.50E+04	N	5.90E+02	N
Dacthal	1861321	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Dalapon	75990	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Danitol	39515418	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
DDD	72548					2.40E-01	I				2.80E-01	C	2.60E-02	C	1.30E-02	C	2.40E+01	C	2.70E+00	C
DDE	72559					3.40E-01	I				2.00E-01	C	1.80E-02	C	9.30E-03	C	1.70E+01	C	1.90E+00	C
DDT	50293	5.00E-04	I			3.40E-01	I	3.40E-01	I		2.00E-01	C	1.80E-02	C	9.30E-03	C	1.70E+01	C	1.90E+00	C
Decabromodiphenyl ether	1163195	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Demeton	8065483	4.00E-05	I								1.50E+00	N	1.50E-01	N	5.40E-02	N	8.20E+01	N	3.10E+00	N
Diallate	2303164					6.10E-02	H			x	1.70E-01	C	1.00E-01	C	5.20E-02	C	9.40E+01	C	1.00E+01	C
Diazinon	333415	9.00E-04	H								3.30E+01	N	3.30E+00	N	1.20E+00	N	1.80E+03	N	7.00E+01	N
Dibenzofuran	132649	4.00E-03	E								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
1,4-Dibromobenzene	106376	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
1,2-Dibromo-3-chloropropane	96128			5.71E-05	I	1.40E+00	H	2.42E-03	H	x	4.80E-02	C	2.10E-01	N	2.30E-03	C	4.10E+00	C	4.60E-01	C
1,2-Dibromoethane	106934			5.71E-05	H	8.50E+01	I	7.70E-01	I	x	7.50E-04	C	8.10E-03	C	3.70E-05	C	6.70E-02	C	7.50E-03	C
Dibutyl phthalate	84742	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Dicamba	1918009	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
**1,2-Dichlorobenzene	95501	9.00E-02	I	9.00E-03	E					x	6.40E+01	N	3.30E+01	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
1,3-Dichlorobenzene	541731	8.90E-02	O							x	5.40E+02	N	3.20E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
1,4-Dichlorobenzene	106467			2.29E-01	I	2.40E-02	H			x	4.40E-01	C	2.60E-01	C	1.30E-01	C	2.40E+02	C	2.70E+01	C
3,3'-Dichlorobenzidine	91941					4.50E-01	I				1.50E-01	C	1.40E-02	C	7.00E-03	C	1.30E+01	C	1.40E+00	C
1,4-Dichloro-2-butene	764410							9.30E+00	H	x	1.10E-03	C	6.70E-04	C	0.00E+00		0.00E+00		0.00E+00	
Dichlorodifluoromethane	75718	2.00E-01	I	5.71E-02	A					x	3.90E+02	N	2.10E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
1,1-Dichloroethane	75343	1.00E-01	H	1.43E-01	A					x	8.10E+02	N	5.20E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
1,2-Dichloroethane (EDC)	107062	3.00E-02	E	1.40E-03	E	9.10E-02	I	9.10E-02	I	x	1.20E-01	C	6.90E-02	C	3.50E-02	C	6.30E+01	C	7.00E+00	C
1,1-Dichloroethylene	75354	9.00E-03	I			6.00E-01	I	1.75E-01	I	x	4.40E-02	C	3.60E-02	C	5.30E-03	C	9.50E+00	C	1.10E+00	C
1,2-Dichloroethylene (cis)	156592	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
1,2-Dichloroethylene (trans)	156605	2.00E-02	I							x	1.20E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1,2-Dichloroethylene (mixture)	540590	9.00E-03	H							x	5.50E+01	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N
2,4-Dichlorophenol	120832	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03	I								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N
1,2-Dichloropropane	78875			1.14E-03	I	6.80E-02	H			x	1.60E-01	C	9.20E-02	C	4.60E-02	C	8.40E+01	C	9.40E+00	C
2,3-Dichloropropanol	616239	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
1,3-Dichloropropene	542756	3.00E-04	I	5.71E-03	I	1.80E-01	H	1.30E-01	H	x	7.70E-02	C	4.80E-02	C	1.80E-02	C	3.20E+01	C	3.50E+00	C
Dichlorvos	62737	5.00E-04	I	1.43E-04	I	2.90E-01	I				2.30E-01	C	2.20E-02	C	1.10E-02	C	2.00E+01	C	2.20E+00	C
Dicofol	115322					4.40E-01	W				1.50E-01	C	1.40E-02	C	7.20E-03	C	1.30E+01	C	1.50E+00	C
Dicyclopentadiene	77736	3.00E-02	H	5.71E-05	A					x	4.20E-01	N	2.10E-01	N	4.10E+01	N	6.10E+04	N	2.30E+03	N

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										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Dieldrin	60571	5.00E-05	I			1.60E+01	I	1.61E+01	I		4.20E-03	C	3.90E-04	C	2.00E-04	C	3.60E-01	C	4.00E-02	C
Diesel emissions	0			1.43E-03	I						5.20E+01	N	5.20E+00	N	0.00E+00		0.00E+00		0.00E+00	
Diethyl phthalate	84662	8.00E-01	I								2.90E+04	N	2.90E+03	N	1.10E+03	N	1.00E+06	N	6.30E+04	N
Diethylene glycol, monobutyl ether	112345			5.71E-03	H						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00		0.00E+00	
Diethylene glycol, monoethyl ether	111900	2.00E+00	H								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
Diethylforamide	617845	1.10E-02	H								4.00E+02	N	4.00E+01	N	1.50E+01	N	2.20E+04	N	8.60E+02	N
Di(2-ethylhexyl)adipate	103231	6.00E-01	I			1.20E-03	I				5.60E+01	C	5.20E+00	C	2.60E+00	C	4.80E+03	C	5.30E+02	C
Diethylstilbestrol	56531					4.70E+03	H				1.40E-05	C	1.30E-06	C	7.00E-07	C	1.20E-03	C	1.40E-04	C
Difenzoquat (Avenge)	43222486	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
Diflubenzuron	35367385	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1,1-Difluoroethane	75376			1.14E+01	I					x	6.90E+04	N	4.20E+04	N	0.00E+00		0.00E+00		0.00E+00	
Diisopropyl methylphosphonate (DIMP)	1445756	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
Dimethipin	55290647	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Dimethoate	60515	2.00E-04	I								7.30E+00	N	7.30E-01	N	2.70E-01	N	4.10E+02	N	1.60E+01	N
3,3'-Dimethoxybenzidine	119904					1.40E-02	H				4.80E+00	C	4.50E-01	C	2.30E-01	C	4.10E+02	C	4.60E+01	C
Dimethylamine	124403			5.71E-06	W						2.10E-01	N	2.10E-02	N	0.00E+00		0.00E+00		0.00E+00	
2,4-Dimethylaniline hydrochloride	21436964					5.80E-01	H				1.20E-01	C	1.10E-02	C	5.40E-03	C	9.90E+00	C	1.10E+00	C
2,4-Dimethylaniline	95681					7.50E-01	H				9.00E-02	C	8.30E-03	C	4.20E-03	C	7.60E+00	C	8.50E-01	C
N-N-Dimethylaniline	121697	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
3,3'-Dimethylbenzidine	119937					9.20E+00	H				7.30E-03	C	6.80E-04	C	3.40E-04	C	6.20E-01	C	6.90E-02	C
N,N-Dimethylformamide	68122	1.00E-01	H	8.57E-03	I						3.70E+03	N	3.10E+01	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
1,1-Dimethylhydrazine	57147					2.60E+00	W	3.50E+00	W		2.60E-02	C	1.80E-03	C	1.20E-03	C	2.20E+00	C	2.50E-01	C
1,2-Dimethylhydrazine	540738					3.70E+01	W	3.70E+01	W		1.80E-03	C	1.70E-04	C	8.50E-05	C	1.50E-01	C	1.70E-02	C
2,4-Dimethylphenol	105679	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
2,6-Dimethylphenol	576261	6.00E-04	I								2.20E+01	N	2.20E+00	N	8.10E-01	N	1.20E+03	N	4.70E+01	N
3,4-Dimethylphenol	95658	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Dimethyl phthalate	131113	1.00E+01	W								3.70E+05	N	3.70E+04	N	1.40E+04	N	1.00E+06	N	7.80E+05	N
Dimethyl terephthalate	120616	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
1,2-Dinitrobenzene	528290	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
1,3-Dinitrobenzene	99650	1.00E-04	I								3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N
1,4-Dinitrobenzene	100254	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
**4,6-Dinitro-2-methylphenol	534521	1.00E-04	E								3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N
2,4-Dinitrophenol	51285	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Dinitrotoluene mixture	0					6.80E-01	I				9.90E-02	C	9.20E-03	C	4.60E-03	C	8.40E+00	C	9.40E-01	C
2,4-Dinitrotoluene	121142	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
2,6-Dinitrotoluene	606202	1.00E-03	H								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Dinoseb	88857	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
di-n-Octyl phthalate	117840	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1,4-Dioxane	123911					1.10E-02	I				6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C	5.80E+01	C
Diphenamid	957517	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N

Risk-Based Concentration Table
October 22, 1997

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E=EPA-NCEA Regional Support provisional value O=Other EPA documents.											N=non-carcinogenic effects									
											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Diphenylamine	122394	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
1,2-Diphenylhydrazine	122667					8.00E-01	I	7.70E-01	I		8.40E-02	C	8.10E-03	C	3.90E-03	C	7.20E+00	C	8.00E-01	C
Diquat	85007	2.20E-03	I								8.00E+01	N	8.00E+00	N	3.00E+00	N	4.50E+03	N	1.70E+02	N
Direct black 38	1937377					8.60E+00	H				7.80E-03	C	7.30E-04	C	3.70E-04	C	6.70E-01	C	7.40E-02	C
Direct blue 6	2602462					8.10E+00	H				8.30E-03	C	7.70E-04	C	3.90E-04	C	7.10E-01	C	7.90E-02	C
Direct brown 95	16071866					9.30E+00	H				7.20E-03	C	6.70E-04	C	3.40E-04	C	6.20E-01	C	6.90E-02	C
Disulfoton	298044	4.00E-05	I								1.50E+00	N	1.50E-01	N	5.40E-02	N	8.20E+01	N	3.10E+00	N
1,4-Dithiane	505293	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Diuron	330541	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Dodine	2439103	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Endosulfan	115297	6.00E-03	I								2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N
Endothall	145733	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Endrin	72208	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Epichlorohydrin	106898	2.00E-03	H	2.86E-04	I	9.90E-03	I	4.20E-03	I		6.80E+00	C	1.00E+00	N	3.20E-01	C	5.80E+02	C	6.50E+01	C
1,2-Epoxybutane	106887			5.71E-03	I						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00		0.00E+00	
Ethephon (2-chloroethyl phosphonic acid)	16672870	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Ethion	563122	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N
2-Ethoxyethanol acetate	111159	3.00E-01	A								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
2-Ethoxyethanol	110805	4.00E-01	H	5.71E-02	I						1.50E+04	N	2.10E+02	N	5.40E+02	N	8.20E+05	N	3.10E+04	N
Ethyl acrylate	140885					4.80E-02	H				1.40E+00	C	1.30E-01	C	6.60E-02	C	1.20E+02	C	1.30E+01	C
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Ethyl acetate	141786	9.00E-01	I								3.30E+04	N	3.30E+03	N	1.20E+03	N	1.00E+06	N	7.00E+04	N
Ethylbenzene	100414	1.00E-01	I	2.86E-01	I					x	1.30E+03	N	1.00E+03	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Ethylene cyanohydrin	109784	3.00E-01	H								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Ethylene diamine	107153	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Ethylene glycol	107211	2.00E+00	I								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
Ethylene glycol, monobutyl ether	111762			5.71E-03	H						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00		0.00E+00	
Ethylene oxide	75218					1.02E+00	H	3.50E-01	H		6.60E-02	C	1.80E-02	C	3.10E-03	C	5.60E+00	C	6.30E-01	C
Ethylene thiourea (ETU)	96457	8.00E-05	I			1.19E-01	H				5.70E-01	C	5.30E-02	C	2.70E-02	C	4.80E+01	C	5.40E+00	C
Ethyl ether	60297	2.00E-01	I							x	1.20E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Ethyl methacrylate	97632	9.00E-02	H								3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05	I								3.70E-01	N	3.70E-02	N	1.40E-02	N	2.00E+01	N	7.80E-01	N
Ethylphthalyl ethyl glycolate	84720	3.00E+00	I								1.10E+05	N	1.10E+04	N	4.10E+03	N	1.00E+06	N	2.30E+05	N
Express	10120	8.00E-03	I								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N
Fenamiphos	22224926	2.50E-04	I								9.10E+00	N	9.10E-01	N	3.40E-01	N	5.10E+02	N	2.00E+01	N
Fluometuron	2164172	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Fluoride	7782414	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
Fluoridone	59756604	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
Flurprimidol	56425913	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Flutolanil	66332965	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
Fluvalinate	69409945	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N

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		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Folpet	133073	1.00E-01	I			3.50E-03	I				1.90E+01	C	1.80E+00	C	9.00E-01	C	1.60E+03	C	1.80E+02	C
Fomesafen	72178020					1.90E-01	I				3.50E-01	C	3.30E-02	C	1.70E-02	C	3.00E+01	C	3.40E+00	C
Fonofos	944229	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Formaldehyde	50000	2.00E-01	I					4.55E-02	I		7.30E+03	N	1.40E-01	C	2.70E+02	N	4.10E+05	N	1.60E+04	N
Formic Acid	64186	2.00E+00	H								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
Fosetyl-al	39148248	3.00E+00	I								1.10E+05	N	1.10E+04	N	4.10E+03	N	1.00E+06	N	2.30E+05	N
Furan	110009	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Furazolidone	67458					3.80E+00	H				1.80E-02	C	1.60E-03	C	8.30E-04	C	1.50E+00	C	1.70E-01	C
Furfural	98011	3.00E-03	I	1.43E-02	A						1.10E+02	N	5.20E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Furium	531828					5.00E+01	H				1.30E-03	C	1.30E-04	C	6.30E-05	C	1.10E-01	C	1.30E-02	C
Furmecyclox	60568050					3.00E-02	I				2.20E+00	C	2.10E-01	C	1.10E-01	C	1.90E+02	C	2.10E+01	C
Glufosinate-ammonium	77182822	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Glycidaldehyde	765344	4.00E-04	I	2.86E-04	H						1.50E+01	N	1.00E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N
Glyphosate	1071836	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Haloxyfop-methyl	69806402	5.00E-05	I								1.80E+00	N	1.80E-01	N	6.80E-02	N	1.00E+02	N	3.90E+00	N
Harmony	79277273	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
HCH (alpha)	319846					6.30E+00	I	6.30E+00	I		1.10E-02	C	9.90E-04	C	5.00E-04	C	9.10E-01	C	1.00E-01	C
HCH (beta)	319857					1.80E+00	I	1.80E+00	I		3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C	3.50E-01	C
HCH (gamma) Lindane	58899	3.00E-04	I			1.30E+00	H				5.20E-02	C	4.80E-03	C	2.40E-03	C	4.40E+00	C	4.90E-01	C
HCH-technical	608731					1.80E+00	I	1.79E+00	I		3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C	3.50E-01	C
Heptachlor	76448	5.00E-04	I			4.50E+00	I	4.55E+00	I	x	2.30E-03	C	1.40E-03	C	7.00E-04	C	1.30E+00	C	1.40E-01	C
Heptachlor epoxide	1024573	1.30E-05	I			9.10E+00	I	9.10E+00	I	x	1.20E-03	C	6.90E-04	C	3.50E-04	C	6.30E-01	C	7.00E-02	C
Hexabromobenzene	87821	2.00E-03	I							x	1.20E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Hexachlorobenzene	118741	8.00E-04	I			1.60E+00	I	1.61E+00	I	x	6.60E-03	C	3.90E-03	C	2.00E-03	C	3.60E+00	C	4.00E-01	C
Hexachlorobutadiene	87683	2.00E-04	H			7.80E-02	I	7.70E-02	I	x	1.40E-01	C	8.10E-02	C	4.00E-02	C	7.30E+01	C	8.20E+00	C
Hexachlorocyclopentadiene	77474	7.00E-03	I	2.00E-05	H					x	1.50E-01	N	7.30E-02	N	9.50E+00	N	1.40E+04	N	5.50E+02	N
Hexachlorodibenzo-p-dioxin mixture	19408743					6.20E+03	I	4.55E+03	I		1.10E-05	C	1.40E-06	C	5.00E-07	C	9.20E-04	C	1.00E-04	C
Hexachloroethane	67721	1.00E-03	I			1.40E-02	I	1.40E-02	I	x	7.50E-01	C	4.50E-01	C	2.30E-01	C	4.10E+02	C	4.60E+01	C
Hexachlorophene	70304	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121824	3.00E-03	I			1.10E-01	I				6.10E-01	C	5.70E-02	C	2.90E-02	C	5.20E+01	C	5.80E+00	C
1,6-Hexamethylene diisocyanate	822060			2.86E-06	I						1.00E-01	N	1.00E-02	N	0.00E+00		0.00E+00		0.00E+00	
n-Hexane	110543	6.00E-02	H	5.71E-02	I					x	3.50E+02	N	2.10E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
**2-Hexanone	73663715	4.00E-02									1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Hexazinone	51235042	3.30E-02	I								1.20E+03	N	1.20E+02	N	4.50E+01	N	6.70E+04	N	2.60E+03	N
Hydrazine, hydrazine sulfate	302012					3.00E+00	I	1.71E+01	I		2.20E-02	C	3.70E-04	C	1.10E-03	C	1.90E+00	C	2.10E-01	C
Hydrogen chloride	7647010			5.71E-03	I						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00		0.00E+00	
Hydrogen sulfide	7783064	3.00E-03	I	2.85E-04	I						1.10E+02	N	1.00E+00	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Hydroquinone	123319	4.00E-02	H								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Imazalil	35554440	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Imazaquin	81335377	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N
Iprodione	36734197	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N

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Contaminant	CAS	RfDo mg/kg/d		RfDi mg/kg/d		CPSo kg·d/mg		CPSi kg·d/mg		VOC	Risk-Based Concentrations: Tap Water µg/L		Ambient Air µg/m3		Fish mg/kg		Soil Ingestion: Industrial mg/kg		Soil Ingestion: Residential mg/kg	
Iron	7439896	3.00E-01	E								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Isobutanol	78831	3.00E-01	I							x	1.80E+03	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Isophorone	78591	2.00E-01	I			9.50E-04	I				7.10E+01	C	6.60E+00	C	3.30E+00	C	6.00E+03	C	6.70E+02	C
Isopropalin	33820530	1.50E-02	I								5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N
Isopropyl methyl phosphonic acid	1832548	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Isoxaben	82558507	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Kepone	143500					1.80E+01	E				3.70E-03	C	3.50E-04	C	1.80E-04	C	3.20E-01	C	3.50E-02	C
Lactofen	77501634	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Linuron	330552	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Lithium	7439932	2.00E-02	E								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Londax	83056996	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Malathion	121755	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Maleic anhydride	108316	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Maleic hydrazide	123331	5.00E-01	I								1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N	3.90E+04	N
Malononitrile	109773	2.00E-05	H								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N
Mancozeb	8018017	3.00E-02	H								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Maneb	12427382	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Manganese and compounds	7439965	2.30E-02	I	1.43E-05	I						8.40E+02	N	5.20E-02	N	3.10E+01	N	4.70E+04	N	1.80E+03	N
Mephosfolan	950107	9.00E-05	H								3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N
Mepiquat chloride	24307264	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Mercuric chloride	7487947	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Mercury (inorganic)	7439976	3.00E-04	W	8.57E-05	I						1.10E+01	N	3.10E-01	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Mercury (methyl)	22967926	1.00E-04	I								3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N
Merphos	150505	3.00E-05	I								1.10E+00	N	1.10E-01	N	4.10E-02	N	6.10E+01	N	2.30E+00	N
Merphos oxide	78488	3.00E-05	I								1.10E+00	N	1.10E-01	N	4.10E-02	N	6.10E+01	N	2.30E+00	N
Metalaxyl	57837191	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
Methacrylonitrile	126987	1.00E-04	I	2.00E-04	A						3.70E+00	N	7.30E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N
Methamidophos	10265926	5.00E-05	I								1.80E+00	N	1.80E-01	N	6.80E-02	N	1.00E+02	N	3.90E+00	N
Methanol	67561	5.00E-01	I								1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N	3.90E+04	N
Methidathion	950378	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Methomyl	16752775	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Methoxychlor	72435	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
2-Methoxyethanol acetate	110496	2.00E-03	A								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
2-Methoxyethanol	109864	1.00E-03	A	5.71E-03	I						3.70E+01	N	2.10E+01	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
2-Methoxy-5-nitroaniline	99592					4.60E-02	H				1.50E+00	C	1.40E-01	C	6.90E-02	C	1.20E+02	C	1.40E+01	C
Methyl acetate	79209	1.00E+00	H								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Methyl acrylate	96333	3.00E-02	A								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
2-Methylaniline hydrochloride	636215					1.80E-01	H				3.70E-01	C	3.50E-02	C	1.80E-02	C	3.20E+01	C	3.50E+00	C
2-Methylaniline	95534					2.40E-01	H				2.80E-01	C	2.60E-02	C	1.30E-02	C	2.40E+01	C	2.70E+00	C
Methyl chlorocarbonate	79221	1.00E+00	W								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
4-(2-Methyl-4-chlorophenoxy) butyric acid	94815	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N

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Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N
2-(2-Methyl-14-chlorophenoxy)propionic acid	93652	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Methylcyclohexane	108872			8.57E-01	H						3.10E+04	N	3.10E+03	N	0.00E+00		0.00E+00		0.00E+00	
Methylene bromide	74953	1.00E-02	A							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Methylene chloride	75092	6.00E-02	I	8.57E-01	H	7.50E-03	I	1.64E-03	I	x	4.10E+00	C	3.80E+00	C	4.20E-01	C	7.60E+02	C	8.50E+01	C
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04	H			1.30E-01	H	1.30E-01	H		5.20E-01	C	4.80E-02	C	2.40E-02	C	4.40E+01	C	4.90E+00	C
4,4'-Methylenebisbenzeneamine	101779					2.50E-01	W				2.70E-01	C	2.50E-02	C	1.30E-02	C	2.30E+01	C	2.60E+00	C
4,4'-Methylene bis(N,N'-dimethyl)aniline	101611					4.60E-02	I				1.50E+00	C	1.40E-01	C	6.90E-02	C	1.20E+02	C	1.40E+01	C
4,4'-Methylenediphenyl isocyanate	101688			5.71E-06	I					x	3.50E-02	N	2.10E-02	N	0.00E+00		0.00E+00		0.00E+00	
Methyl ethyl ketone	78933	6.00E-01	I	2.86E-01	I					x	1.90E+03	N	1.00E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N
Methyl hydrazine	60344					1.10E+00	W				6.10E-02	C	5.70E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C
Methyl isobutyl ketone	108101	8.00E-02	H	2.29E-02	A						2.90E+03	N	8.40E+01	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
Methyl methacrylate	80626	8.00E-02	H								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
2-Methyl-5-nitroaniline	99558					3.30E-02	H				2.00E+00	C	1.90E-01	C	9.60E-02	C	1.70E+02	C	1.90E+01	C
Methyl parathion	298000	2.50E-04	I								9.10E+00	N	9.10E-01	N	3.40E-01	N	5.10E+02	N	2.00E+01	N
2-Methylphenol (o-cresol)	95487	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
3-Methylphenol (m-cresol)	103394	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
4-Methylphenol (p-cresol)	106445	5.00E-03	H								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Methyl styrene (mixture)	25013154	6.00E-03	A	1.14E-02	A					x	6.00E+01	N	4.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N
Methyl styrene (alpha)	98839	7.00E-02	A							x	4.30E+02	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03	E	8.57E-01	I					x	1.80E+02	N	3.10E+03	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Metolaclor (Dual)	51218452	1.50E-01	H								5.50E+03	N	5.50E+02	N	2.00E+02	N	3.10E+05	N	1.20E+04	N
Metribuzin	21087649	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Mirex	2385855	2.00E-04	I			1.80E+00	W				3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C	3.50E-01	C
Molinate	2212671	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Molybdenum	7439987	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Monochloramine	10599903	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Naled	300765	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
2-Naphthylamine	91598					1.30E+02	E				5.20E-04	C	4.80E-05	C	2.40E-05	C	4.40E-02	C	4.90E-03	C
Napropamide	15299997	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Nickel refinery dust	0							8.40E-01	I		0.00E+00		7.50E-03	C	0.00E+00		0.00E+00		0.00E+00	
Nickel and compounds	7440020	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Nickel subsulfide	12035722							1.70E+00	I		0.00E+00		3.70E-03	C	0.00E+00		0.00E+00		0.00E+00	
Nitrapyrin	1929824	1.50E-03	W								5.50E+01	N	5.50E+00	N	2.00E+00	N	3.10E+03	N	1.20E+02	N
Nitrate	14797558	1.60E+00	I								5.80E+04	N	5.80E+03	N	2.20E+03	N	1.00E+06	N	1.30E+05	N
Nitric oxide	10102439	1.00E-01	W								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
Nitrite	14797650	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
2-Nitroaniline	88744	6.00E-05	W	5.71E-05	H						2.20E+00	N	2.10E-01	N	8.10E-02	N	1.20E+02	N	4.70E+00	N
3-Nitroaniline	99092	3.00E-03	O								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
4-Nitroaniline	100016	3.00E-03	O								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Nitrobenzene	98953	5.00E-04	I	5.71E-04	A					x	3.40E+00	N	2.10E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N

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Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Nitrofurantoin	67209	7.00E-02	H								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
Nitrofurazone	59870					1.50E+00	H	9.40E+00	W		4.50E-02	C	6.70E-04	C	2.10E-03	C	3.80E+00	C	4.30E-01	C
Nitrogen dioxide	10102440	1.00E+00	W								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Nitroguanidine	556887	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
**4-Nitrophenol	100027	8.00E-03	E								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N
2-Nitropropane	79469			5.71E-03	I			9.40E+00	H		2.10E+02	N	6.70E-04	C	0.00E+00		0.00E+00		0.00E+00	
N-Nitrosodi-n-butylamine	924163					5.40E+00	I	5.60E+00	I		1.20E-02	C	1.10E-03	C	5.80E-04	C	1.10E+00	C	1.20E-01	C
N-Nitrosodiethanolamine	1116547					2.80E+00	I				2.40E-02	C	2.20E-03	C	1.10E-03	C	2.00E+00	C	2.30E-01	C
N-Nitrosodiethylamine	55185					1.50E+02	I	1.51E+02	I		4.50E-04	C	4.10E-05	C	2.10E-05	C	3.80E-02	C	4.30E-03	C
N-Nitrosodimethylamine	62759					5.10E+01	I	4.90E+01	I		1.30E-03	C	1.30E-04	C	6.20E-05	C	1.10E-01	C	1.30E-02	C
N-Nitrosodiphenylamine	86306					4.90E-03	I				1.40E+01	C	1.30E+00	C	6.40E-01	C	1.20E+03	C	1.30E+02	C
N-Nitroso di-n-propylamine	621647					7.00E+00	I				9.60E-03	C	8.90E-04	C	4.50E-04	C	8.20E-01	C	9.10E-02	C
N-Nitroso-N-ethylurea	759739					1.40E+02	H				4.80E-04	C	4.50E-05	C	2.30E-05	C	4.10E-02	C	4.60E-03	C
N-Nitroso-N-methylethylamine	10595956					2.20E+01	I				3.10E-03	C	2.80E-04	C	1.40E-04	C	2.60E-01	C	2.90E-02	C
N-Nitrosopyrrolidine	930552					2.10E+00	I	2.13E+00	I		3.20E-02	C	2.90E-03	C	1.50E-03	C	2.70E+00	C	3.00E-01	C
m-Nitrotoluene	99081	2.00E-02	H							x	1.20E+02	N	7.30E+01	N	2.70E+01	N	4.10E+03	N	1.60E+03	N
o-Nitrotoluene	88722	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
p-Nitrotoluene	99990	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Norflurazon	27314132	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
NuStar	85509199	7.00E-04	I								2.60E+01	N	2.60E+00	N	9.50E-01	N	1.40E+03	N	5.50E+01	N
Octabromodiphenyl ether	32536520	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Octahydro-1357-tetranitro-1357-tetrazocine	2691410	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Octamethylpyrophosphoramide	152169	2.00E-03	H								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Oryzalin	19044883	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Oxadiazon	19666309	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Oxamyl	23135220	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Oxyfluorfen	42874033	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Paclobutrazol	76738620	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Paraquat	1910425	4.50E-03	I								1.60E+02	N	1.60E+01	N	6.10E+00	N	9.20E+03	N	3.50E+02	N
Parathion	56382	6.00E-03	H								2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N
Pebulate	1114712	5.00E-02	H								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Pendimethalin	40487421	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Pentabromo-6-chlorocyclohexane	87843					2.30E-02	H				2.90E+00	C	2.70E-01	C	1.40E-01	C	2.50E+02	C	2.80E+01	C
Pentabromodiphenyl ether	32534819	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Pentachlorobenzene	608935	8.00E-04	I							x	4.90E+00	N	2.90E+00	N	1.10E+00	N	1.60E+03	N	6.30E+01	N
Pentachloronitrobenzene	82688	3.00E-03	I			2.60E-01	H			x	4.10E-02	C	2.40E-02	C	1.20E-02	C	2.20E+01	C	2.50E+00	C
Pentachlorophenol	87865	3.00E-02	I			1.20E-01	I				5.60E-01	C	5.20E-02	C	2.60E-02	C	4.80E+01	C	5.30E+00	C
Permethrin	52645531	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Phenmedipham	13684634	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N
Phenol	108952	6.00E-01	I								2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N
m-Phenylenediamine	108452	6.00E-03	I								2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N

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		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
**o-Phenylenediamine	95545	6.00E-03	E			4.70E-02	H				1.40E+00	C	1.30E-01	C	6.70E-02	C	1.20E+02	C	1.40E+01	C
p-Phenylenediamine	106503	1.90E-01	H								6.90E+03	N	6.90E+02	N	2.60E+02	N	3.90E+05	N	1.50E+04	N
Phenylmercuric acetate	62384	8.00E-05	I								2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N
2-Phenylphenol	90437					1.94E-03	H				3.50E+01	C	3.20E+00	C	1.60E+00	C	3.00E+03	C	3.30E+02	C
Phorate	298022	2.00E-04	H								7.30E+00	N	7.30E-01	N	2.70E-01	N	4.10E+02	N	1.60E+01	N
Phosmet	732116	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Phosphine	7803512	3.00E-04	I	8.57E-05	I						1.10E+01	N	3.10E-01	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Phosphoric acid	7664382			2.86E-03	I						1.00E+02	N	1.00E+01	N	0.00E+00		0.00E+00		0.00E+00	
Phosphorus (white)	7723140	2.00E-05	I								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N
p-Phthalic acid	100210	1.00E+00	H								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Phthalic anhydride	85449	2.00E+00	I	3.43E-02	H						7.30E+04	N	1.30E+02	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
Picloram	1918021	7.00E-02	I								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
Pirimiphos-methyl	29232937	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Polybrominated biphenyls	0	7.00E-06	H			8.90E+00	H				7.60E-03	C	7.00E-04	C	3.50E-04	C	6.40E-01	C	7.20E-02	C
**Polychlorinated biphenyls (PCBs)	1336363					2.00E+00	I	4.00E-01	I		3.40E-02	C	1.60E-02	C	1.60E-03	C	2.90E+00	C	3.20E-01	C
Aroclor 1016	12674112	7.00E-05	I								2.60E+00	N	2.60E-01	N	9.50E-02	N	1.40E+02	N	5.50E+00	N
Aroclor 1254	11097691	2.00E-05	I								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N
Polychlorinated terphenyls (PCTs)	0					4.50E+00	E				1.50E-02	C	1.40E-03	C	7.00E-04	C	1.30E+00	C	1.40E-01	C
Polynuclear aromatic hydrocarbons	0										0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Acenaphthene	83329	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N
Anthracene	120127	3.00E-01	I								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
**Benz[a]anthracene	56553					7.30E-01	E	3.10E-01	E		9.20E-02	C	2.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C
**Benzo[b]fluoranthene	205992					7.30E-01	E	3.10E-01	E		9.20E-02	C	2.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C
**Benzo[k]fluoranthene	207089					7.30E-02	E	3.10E-02	E		9.20E-01	C	2.00E-01	C	4.30E-02	C	7.80E+01	C	8.80E+00	C
**Benzo[a]pyrene	50328					7.30E+00	I	3.10E+00	E		9.20E-03	C	2.00E-03	C	4.30E-04	C	7.80E-01	C	8.80E-02	C
Carbazole	86748					2.00E-02	H				3.40E+00	C	3.10E-01	C	1.60E-01	C	2.90E+02	C	3.20E+01	C
**Chrysene	218019					7.30E-03	E	3.10E-03	E		9.20E+00	C	2.00E+00	C	4.30E-01	C	7.80E+02	C	8.80E+01	C
**Dibenz[ah]anthracene	53703					7.30E+00	E	3.10E+00	E		9.20E-03	C	2.00E-03	C	4.30E-04	C	7.80E-01	C	8.80E-02	C
Fluoranthene	206440	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Fluorene	86737	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
**Indeno[1,2,3-cd]pyrene	193395					7.30E-01	E	3.10E-01	E		9.20E-02	C	2.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C
**2-Methylnaphthalene	91576	4.00E-02	E								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Naphthalene	91203	4.00E-02	W								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N
Pyrene	129000	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Prochloraz	67747095	9.00E-03	I			1.50E-01	I				4.50E-01	C	4.20E-02	C	2.10E-02	C	3.80E+01	C	4.30E+00	C
Profluralin	26399360	6.00E-03	H								2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N
Prometon	1610180	1.50E-02	I								5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N
Prometryn	7287196	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Pronamide	23950585	7.50E-02	I								2.70E+03	N	2.70E+02	N	1.00E+02	N	1.50E+05	N	5.90E+03	N
Propachlor	1918167	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Propanil	709988	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N

Risk-Based Concentration Table
October 22, 1997

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST
E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis : C=carcinogenic effects
N=non-carcinogenic effects

											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Propargite	2312358	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Propargyl alcohol	107197	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N
Propazine	139402	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Propham	122429	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Propiconazole	60207901	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
**n-Propylbenzene	98066	1.00E-02	E							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
Propylene glycol	57556	2.00E+01	H								7.30E+05	N	7.30E+04	N	2.70E+04	N	1.00E+06	N	1.00E+06	N
Propylene glycol, monoethyl ether	52125538	7.00E-01	H								2.60E+04	N	2.60E+03	N	9.50E+02	N	1.00E+06	N	5.50E+04	N
Propylene glycol, monomethyl ether	107982	7.00E-01	H	5.71E-01	I						2.60E+04	N	2.10E+03	N	9.50E+02	N	1.00E+06	N	5.50E+04	N
Propylene oxide	75569			8.57E-03	I	2.40E-01	I	1.29E-02	I		2.80E-01	C	4.90E-01	C	1.30E-02	C	2.40E+01	C	2.70E+00	C
Pursuit	81335775	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N
Pydrin	51630581	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Pyridine	110861	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Quinalphos	13593038	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N
Quinoline	91225					1.20E+01	H				5.60E-03	C	5.20E-04	C	2.60E-04	C	4.80E-01	C	5.30E-02	C
Resmethrin	10463868	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Ronnel	299843	5.00E-02	H								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Rotenone	83794	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Savey	78587050	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Selenious Acid	7783008	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Selenium	7782492	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Selenourea	630104	5.00E-03	H								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Sethoxydim	74051802	9.00E-02	I								3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N
Silver and compounds	7440224	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Simazine	122349	5.00E-03	I			1.20E-01	H				5.60E-01	C	5.20E-02	C	2.60E-02	C	4.80E+01	C	5.30E+00	C
Sodium azide	26628228	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N
Sodium diethyldithiocarbamate	148185	3.00E-02	I			2.70E-01	H				2.50E-01	C	2.30E-02	C	1.20E-02	C	2.10E+01	C	2.40E+00	C
Sodium fluoroacetate	62748	2.00E-05	I								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N
Sodium metavanadate	13718268	1.00E-03	H								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Strontium, stable	7440246	6.00E-01	I								2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N
Strychnine	57249	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Styrene	100425	2.00E-01	I	2.86E-01	I					x	1.60E+03	N	1.00E+03	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Systhane	88671890	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
**2,3,7,8-TCDD (dioxin)	1746016					1.50E+05	H	1.50E+05	H		4.50E-07	C	4.20E-08	C	0.00E+00	C	3.80E-05	C	4.30E-06	C
Tebuthiuron	34014181	7.00E-02	I								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N
Temephos	3383968	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Terbacil	5902512	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Terbufos	13071799	2.50E-05	H								9.10E-01	N	9.10E-02	N	3.40E-02	N	5.10E+01	N	2.00E+00	N
Terbutryn	886500	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04	I							x	1.80E+00	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
1,1,1,2-Tetrachloroethane	630206	3.00E-02	I			2.60E-02	I	2.59E-02	I	x	4.10E-01	C	2.40E-01	C	1.20E-01	C	2.20E+02	C	2.50E+01	C

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											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
1,1,2,2-Tetrachloroethane	79345					2.00E-01	I	2.03E-01	I	x	5.20E-02	C	3.10E-02	C	1.60E-02	C	2.90E+01	C	3.20E+00	C
Tetrachloroethylene (PCE)	127184	1.00E-02	I			5.20E-02	E	2.03E-03	E	x	1.10E+00	C	3.10E+00	C	6.10E-02	C	1.10E+02	C	1.20E+01	C
2,3,4,6-Tetrachlorophenol	58902	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
p,a,a,a-Tetrachlorotoluene	5216251					2.00E+01	H			x	5.30E-04	C	3.10E-04	C	1.60E-04	C	2.90E-01	C	3.20E-02	C
Tetrachlorovinphos	961115	3.00E-02	I			2.40E-02	H				2.80E+00	C	2.60E-01	C	1.30E-01	C	2.40E+02	C	2.70E+01	C
Tetraethyldithiopyrophosphate	3689245	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N
Tetraethyl lead	78002	1.00E-07	I								3.70E-03	N	3.70E-04	N	1.40E-04	N	2.00E-01	N	7.80E-03	N
1,1,1,2-Tetrafluoroethane	811972		I	2.29E+01						x	1.40E+05	N	8.40E+04	N	0.00E+00		0.00E+00		0.00E+00	
Thallic oxide	1314325	7.00E-05	W								2.60E+00	N	2.60E-01	N	9.50E-02	N	1.40E+02	N	5.50E+00	N
Thallium	0										0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Thallium acetate	563688	9.00E-05	I								3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N
Thallium carbonate	6533739	8.00E-05	I								2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N
Thallium chloride	7791120	8.00E-05	I								2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N
Thallium nitrate	10102451	9.00E-05	I								3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N
Thallium selenite	12039520	9.00E-05	W								3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N
Thallium sulfate	7446186	8.00E-05	I								2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N
Thiobencarb	28249776	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02	H								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Thiofanox	39196184	3.00E-04	H								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Thiophanate-methyl	23564058	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N
Thiram	137268	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Tin and compounds	0	6.00E-01	H								2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N
**Titanium	7440326	4.00E+00	E	8.60E-03	E						1.50E+05	N	3.10E+01	N	5.40E+03	N	1.00E+06	N	3.10E+05	N
**Titanium dioxide	13643677	4.00E+00	E	8.60E-03	E						1.50E+05	N	3.10E+01	N	5.40E+03	N	1.00E+06	N	3.10E+05	N
Toluene	108883	2.00E-01	I	1.14E-01	I					x	7.50E+02	N	4.20E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
Toluene-2,4-diamine	95807					3.20E+00	H				2.10E-02	C	2.00E-03	C	9.90E-04	C	1.80E+00	C	2.00E-01	C
Toluene-2,5-diamine	95705	6.00E-01	H								2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N
Toluene-2,6-diamine	823405	2.00E-01	H								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N
p-Toluidine	106490					1.90E-01	H				3.50E-01	C	3.30E-02	C	1.70E-02	C	3.00E+01	C	3.40E+00	C
Toxaphene	8001352					1.10E+00	I	1.12E+00	I		6.10E-02	C	5.60E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C
Tralomethrin	66841256	7.50E-03	I								2.70E+02	N	2.70E+01	N	1.00E+01	N	1.50E+04	N	5.90E+02	N
Triallate	2303175	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N
Triasulfuron	82097505	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
1,2,4-Tribromobenzene	615543	5.00E-03	I							x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
Tributyltin oxide (TBTO)	56359	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
2,4,6-Trichloroaniline hydrochloride	33663502					2.90E-02	H				2.30E+00	C	2.20E-01	C	1.10E-01	C	2.00E+02	C	2.20E+01	C
2,4,6-Trichloroaniline	634935					3.40E-02	H				2.00E+00	C	1.80E-01	C	9.30E-02	C	1.70E+02	C	1.90E+01	C
1,2,4-Trichlorobenzene	120821	1.00E-02	I	5.71E-02	H					x	1.90E+02	N	2.10E+02	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
**1,1,1-Trichloroethane	71556	2.00E-02	E	2.86E-01	W					x	5.40E+02	N	1.00E+03	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
1,1,2-Trichloroethane	79005	4.00E-03	I			5.70E-02	I	5.60E-02	I	x	1.90E-01	C	1.10E-01	C	5.50E-02	C	1.00E+02	C	1.10E+01	C
Trichloroethylene (TCE)	79016	6.00E-03	E			1.10E-02	W	6.00E-03	E	x	1.60E+00	C	1.00E+00	C	2.90E-01	C	5.20E+02	C	5.80E+01	C

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST
E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis : C=carcinogenic effects
N=non-carcinogenic effects

											Risk-Based Concentrations									
										V	Tap		Ambient				Soil Ingestion			
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg	
Trichlorofluoromethane	75694	3.00E-01	I	2.00E-01	A					x	1.30E+03	N	7.30E+02	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
2,4,5-Trichlorophenol	95954	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N
2,4,6-Trichlorophenol	88062					1.10E-02	I	1.09E-02	I		6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C	5.80E+01	C
2,4,5-Trichlorophenoxyacetic acid	93765	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
2-(2,4,5-Trichlorophenoxy)propionic acid	93721	8.00E-03	I								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N
1,1,2-Trichloropropane	598776	5.00E-03	I							x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
1,2,3-Trichloropropane	96184	6.00E-03	I			7.00E+00	H			x	1.50E-03	C	8.90E-04	C	4.50E-04	C	8.20E-01	C	9.10E-02	C
1,2,3-Trichloropropene	96195	5.00E-03	H							x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N
1,1,2-Trichloro-1,2,2- trifluoroethane	76131	3.00E+01	I	8.57E+00	H					x	5.90E+04	N	3.10E+04	N	4.10E+04	N	1.00E+06	N	1.00E+06	N
Tridiphane	58138082	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Triethylamine	121448			2.00E-03	I						7.30E+01	N	7.30E+00	N	0.00E+00		0.00E+00		0.00E+00	
Trifluralin	1582098	7.50E-03	I			7.70E-03	I				8.70E+00	C	8.10E-01	C	4.10E-01	C	7.40E+02	C	8.30E+01	C
**1,2,4-Trimethylbenzene	95636	5.00E-02	E	1.70E-03	E					x	1.20E+01	N	6.20E+00	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
**1,3,5-Trimethylbenzene	108678	5.00E-02	E	1.70E-03	E					x	1.20E+01	N	6.20E+00	N	6.80E+01	N	1.00E+05	N	3.90E+03	N
Trimethyl phosphate	512561					3.70E-02	H				1.80E+00	C	1.70E-01	C	8.50E-02	C	1.50E+02	C	1.70E+01	C
**1,3,5-Trinitrobenzene	99354	3.00E-02	E								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N
Trinitrophenylmethylnitramine	479458	1.00E-02	H								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N
2,4,6-Trinitrotoluene	118967	5.00E-04	I			3.00E-02	I				2.20E+00	C	2.10E-01	C	1.10E-01	C	1.90E+02	C	2.10E+01	C
Uranium (soluble salts)	7440611	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N
Vanadium	7440622	7.00E-03	H								2.60E+02	N	2.60E+01	N	9.50E+00	N	1.40E+04	N	5.50E+02	N
Vanadium pentoxide	1314621	9.00E-03	I								3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N
Vanadium sulfate	36907423	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N
Vernam	1929777	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N
Vinclozolin	50471448	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N
Vinyl acetate	108054	1.00E+00	H	5.71E-02	I						3.70E+04	N	2.10E+02	N	1.40E+03	N	1.00E+06	N	7.80E+04	N
Vinyl bromide	593602			8.57E-04	I					x	5.20E+00	N	3.10E+00	N	0.00E+00		0.00E+00		0.00E+00	
Vinyl chloride	75014					1.90E+00	H	3.00E-01	H	x	1.90E-02	C	2.10E-02	C	1.70E-03	C	3.00E+00	C	3.40E-01	C
Warfarin	81812	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
m-Xylene	108323	2.00E+00	H							x	1.20E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
o-Xylene	95476	2.00E+00	H							x	1.20E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
p-Xylene	106423									x	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Xylene (mixed)	1330207	2.00E+00	I							x	1.20E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N
Zinc	7440666	3.00E-01	I								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N
Zinc phosphide	1314847	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N
Zineb	12122677	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N

APPENDIX C

IDW SOIL SAMPLING LOGS

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 1 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: NA

Sample I.D. No. 970822 -LD-IW -SL 0021 Coded/Replicate No. —

Date 8/22/97 Time of Sampling: Begin 1055 End

Weather SUNNY 80's

Site Description AT DECON AREA

1 DRUM

SAMPLING DATA

Collection Method ~~Split spoon~~ STAINLESS STEEL SPOON

Depth NA Moisture Content MOIST

Color OLIVE GRAY (5Y3/2) Odor ORGANIC

Description CLAY & ROCK

Analyses Required	Container Description From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 2 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: ~~MW-29~~ ~~(KT) 9/17/97~~ KT 10/13/97

Sample I.D. No. 970822-LD-1W-SL0029 Coded/Replicate No.

Date 8/22/97 Time of Sampling: Begin 1640 End

Weather SUNNY, 80's, NW WIND 5mph

Site Description AT DECON AREA

SAMPLING DATA

Collection Method Split spoon:

Depth NA Moisture Content SATURATED

Color LIGHT BROWN (5YR 5/6) & DUSKY BROWN (5YR 2/2) Odor —

Description CLAY, ROCK (LIMESTONE), & SAND (20/30 FILTER SAND)

Analyses Required	Container Description: From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 3 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: NA

Sample I.D. No. 970822 -LD-1W -SL0031 A, B, & C Coded/Replicate No. –

Date 8/22/97 Time of Sampling: Begin 1545 End

Weather SUNNY 80's, NE WIND 0-5 mph

Site Description AT DECON AREA

SAMPLING DATA

Collection Method Split spoon

Depth NA Moisture Content SATURATED

Color MOD GRAY (N7) A & B, BLACK - C Odor –

Description A LIMESTONE
B FLUE DUST
C FLUE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 4 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: NA

Sample I.D. No. 970822-LD-1W-SL0032 Coded/Replicate No. —

Date 8/21/97 Time of Sampling: Begin 1625 End

Weather SUNNE NW WIND 5mph

Site Description AT DECON AREA

SAMPLING DATA

Collection Method Split spoon.

Depth NA Moisture Content DRY.

Color BLACK Odor —

Description FINE DUST

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 5 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: NA

Sample I.D. No. 970822-LD-1W-SL0033 A B & C Coded/Replicate No. —

Date 8/22/97 Time of Sampling: Begin 1515 End

Weather SUNNY, 80's, E WIND 5mph

Site Description AT DECON AREA

SAMPLING DATA

Collection Method Split spoon

Depth Moisture Content SATURATED

Color BLACK & MED GRAY-(N 7)-DRUM B Odor —

Description A - FLUEDUST
B - LIMESTONE
C - FLUEDUST

Analyses Required	Container Description (From Lab X or G&M)
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 6 of 8

Site Location Sloss Industries, Birmingham, AL Location Name:

Sample I.D. No. 970822-LD-1W-SL0035 A&B Coded/Replicate No. —

Date 8/22/97 Time of Sampling: Begin 1115 End

Weather

Site Description ATTRECON AREA

A - CLAY

B - ROCK

SAMPLING DATA

Collection Method Split spoon

Depth NA Moisture Content SATURATED

Color MED GRAY (N7) & DARK YELLOWISH BROWN (10YR 4/2) Odor —

Description CLAY & ROCK

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 7 of 8

Site Location Sloss Industries, Birmingham, AL Location Name: NA

Sample I.D. No. 970822-LD-IW-SL0037 Coded/Replicate No.

Date 8/22/97 Time of Sampling: Begin 1445 End

Weather SUNNY 80's 5mph WIND E

Site Description AT DECON AREA

SAMPLING DATA

Collection Method Split spoon

Depth NA Moisture Content SATURATED

Color MED GRAY (N7) Odor —

Description LIMESTONE

Analyses Required	Container Description
	From Lab X or G&M
Priority Pollutant Metals & Barium (6010 & 7471)	1 x 4 oz
VOCs (8260)	1 x 8 oz
SVOCs (8270)	1 x 8 oz
Cyanide (9010)	1 x 8 oz

Sample Monitoring (TIP, OVA, HNU, etc.)

Remarks Non VOC's Composited in stainless steel bowl with stainless steel spoon

Sampler(s) J. Hughes

Southprint 89-1093

GERAGHTY & MILLER, INC.
Environmental Services

SOIL/SEDIMENT SAMPLING LOG

Project No. TF0320.015 Page 8 of 8

Site Location SLOSS INDUSTRIES, BIRMINGHAM, AL LOCATION: NA

Sample I.D. No. 970822-LD-1W-SL9999 A & B & C Coded/Replicate No. —

Date 8/22/97 Time of Sampling: Begin 1705 End

Weather SUNNY 80's

Site Description AT DECON PAD

3 DRUMS

SAMPLING DATA

Collection Method STAINLESS STEEL SPOON

Depth NA Moisture Content MOIST

Color MOD BROWN (5YR 4/4) & MOD YELLOWISH BROWN (10YR5/4) Odor —

Description VISQUENE & SOIL

Analyses Required	Container Description
	From Lab ✓ or G&M
PRIORITY POLLUTANT METALS	1 x 8oz
VOCs (8260)	1 x 4oz
SVOCs (8270)	1 x 8oz
CYANIDE (9010)	1 x 8oz

Sample Monitoring (TIP, OVA, HNU, etc.) —

Remarks SAMPLES COLLECTED FROM A & B ONLY SINCE DRUM C HAD ONLY VISQUENE W/A SLIGHT SOIL COATING IN IT. NON VOC's COMPOSITED IN STAINLESS STEEL BOWL W/ STAINLESS STEEL SPOON

Sampler(s) J. HUGHES

I, ~~S D Durstun~~ S D Durstun, am responsible for filing documents in the

(Name of file) Sloss Ind. Inc. file. The attached document,

(Name of document) RCRA Facil. Inv. - Land Disposal Areas Vol II of III

was originally submitted to the Alabama Department of Environmental Management in a 3-ring binder.

For ease of filing, only the binder has changed. No material has changed in the document. No other alterations have been made to said document, and it is otherwise in its original form as submitted to the Alabama Department of Environmental Management.

S D Durstun

Done this 27th of Dec, 2000

Witness: [signature]